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THE GREAT TEXTILE INVENTION AT THE CENTENNIAL EXPOSITION—THE LYALL POSITIVE MOTION LOOM.

To trace back the complete history of the art of weaving would be to transcend that shadowy limit where begins the existence of the human race. The oriole and the weaver bird wove together twigs and rushes, to form their pendent nests, ages before the foot of man trod the earth; and from these, probably, the primeval savage learned to knit together fibers of plants and hair of animals into the rude prototype of the fabrics which have replaced the skins of beasts as human clothing. It is a marvelous fact, unparalleled elsewhere in the record of human progress, that, from the period when the loom was first devised—a period which we know to be earlier than the time of Jacob, for stone inscriptions of the era of that patriarch, in which weaving is referred to, have been deciphered—no great improvement or even modification in its mechanism was made until the year 1678, when De Gennes, a French naval officer, conceived the idea of a loom, driven by power other than that of the weaver himself. De Gennes started a current of invention, sluggish but onward in its tendency; and since his day, innumerable improvements in loom machinery have been made, keeping pace in large measure with advancement in other arts. But neither original invention nor the addition of improvements has uniformly affected all parts of the loom. We can point to marvels of ingenuity in the methods for producing intricate and curious tissues, for guiding and regulating the motion, and even to a wonderful application of electricity in a device for superseding the Jacquard apparatus in its present form; but when we look for a means of producing apparently so simple a result as carrying the shuttle through the open warp, there has been no universally practicable improvement since John Kay, in 1740, invented the flying shuttle still in use in the great majority of looms.

EARLY SHUTTLE MOTIONS.

That to substitute a positive, absolute, and uniform motion in the shuttle by means of an external appliance

Continued on page 180.

LYALL'S GREAT TEXTILE EXHIBIT AT THE CENTENNIAL.

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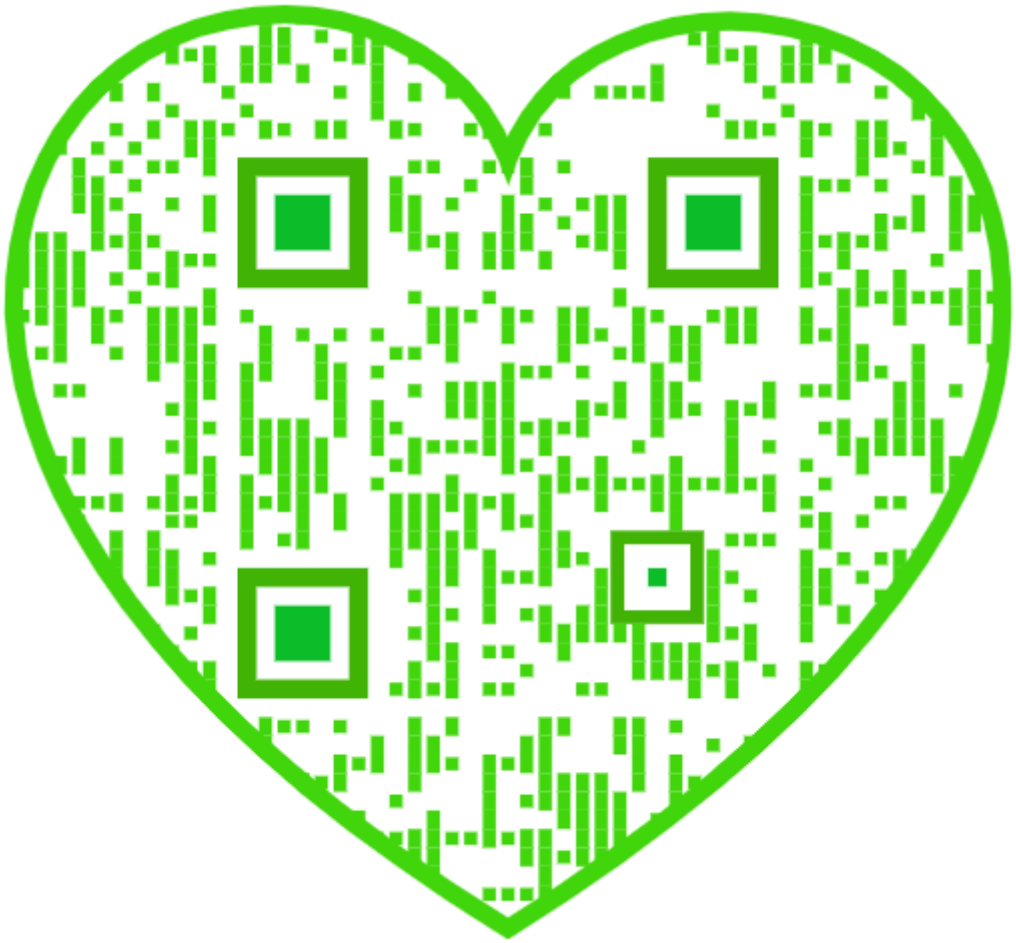

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Contents.

(Illustrated articles are marked with an asterisk.)

Aloe, the pearly*..... 183
American Science Association.... 185
Aniline dyes poisonous (36)..... 188
Answers to correspondents..... 187
Antimony in type metal (37)..... 188
Battery, cheap (21) 187
Better times at hand..... 187
Boilers, foaming (23)..... 187
Boilers, lagging (3)..... 187
Business and personal..... 187
Canning fruit (20)..... 187
Casehardening iron (35)..... 188
Centennial buildings, value of.... 179
Centennial, rotary engine at the* 182
Centennial loom exhibit*..175, 180, 181
Coal, cheap..... 176
Coal dust as fuel..... 179
Colors of animals..... 185
Connecting rod motion (1)..... 187
Development theory in America.. 176
Diagometer, Rousseau's*..... 184
Draft regulator, automatic*..... 179
Dyeing leather black (29)..... 187
Eggshells, utilizing (45)..... 188
Electric clocks (46)..... 188
Electrical experiments, new*..... 184
Electric eggs*..... 184
Electric light*..... 181
Electric valve*..... 181
Engine, speed of an (2, 25)..... 187
Engine, the Lidgerwood rotary* 182
Engraving, steel plate..... 185
Errata..... 178
Farmers, sensible assertion for... 182
Flowers, fertilization of..... 185
Gages, the battle of the..... 183
Ganoids, North American..... 185
Gates, hanging for*..... 179
Glycerin, burning (31)..... 187
Gold, cleaning mercury from (43) 188
Gunpowder, power of (19)..... 187
Gutters, leaks in (34)..... 187
Hair, falling..... 181
Heating by furnace (35) 188
Hell Gate, the coming explosion.. 176
Highways, constructing public.... 183
Hose attachment for faucets*.... 182
Icehouse, building an (41)..... 188
Inventions patented in England.. 185
Jonathan, is he very slim?..... 177
Journals, fitting (23)..... 187
Kerosene, tubes for (38)..... 188
Lightning rods (9, 10)..... 187
Linseed oil stains (28)..... 187
Lizards, flying, of America..... 185
Locomotives, steep grade..... 181
Loom exhibit, Lyall's*....175, 180, 181
Lumbertoo dry, (18)..... 187
Lyall's loom exhibit*.... 175, 180, 181
Magnet helices, winding (6)..... 187
Magnetic cut-off (47)..... 188
Magnets, poles of (7)..... 187
Maternity, joint stock..... 179
Mechanical movement science.... 177
Mechanism, a masterpiece of*.... 183
Mica, pulverizing (30)..... 187
Mortar, cement (32)..... 187
Naval items..... 185
New books and publications..... 185
Odontograph, new..... 181
Paint, fireproof (16)..... 187
Parasol and umbrella handle*.... 178
Patent our ideas, why not..... 178
Patents, American and foreign.. 185
Patents, official list of 188
Pavement, Nicholson 183
Pavements, wood..... 183
Pipes, strength of steel (26)..... 187
Piston, improved*..... 182
Plaster, tough (14)..... 187
Plate, to clean..... 184
Plowing with three horses (44) ... 188
Printing, the hand in (11)..... 187
Quicksilver furnace flues (39)..... 188
Railway economy..... 183
Refraction in prisms..... 185
Safe, a marine*..... 179
Sewer gas trap*..... 182
Shuttle, the positive motion*..... 180
Slide valves, setting (4)..... 187
Slim, is Jonathan very..... 177
Soldering liquid (21)..... 187
Spectroscope, new form of..... 185
Steam joints, rusting (13)..... 187
Steelyard poises (22)..... 187
Teeth, artificial..... 177
Tomato leaves, property of..... 188
Truffle, the origin of the..... 177
Watch, escapement action (24)... 187
Water, impure.....(33) 187, (48) 188
Water pipes (12)..... 187
Water, pressure of (31)..... 187
Water, rain, in lead pipes..... 179
Weight in a hollow sphere*..... 181
Weight on and in the earth*..... 181
Why not?..... 176
Zodiacal light, the..... 185

THE SCIENTIFIC AMERICAN SUPPLEMENT.
Vol. II., No. 38.
For the Week ending September 16, 1876.
With 67 Figures.
TABLE OF CONTENTS.

1. THE INTERNATIONAL EXHIBITION OF 1876. With 11 illustrations.—The Swedish Meteorograph, 1 engraving.—West Virginia State Building, 1 engraving.—The Gold and Silver Display.—British Colonial Gold.—Silver Exhibits.—South American Gold and Silver.—European Exhibits.—American Gold and Silver.—Gold Ores.—Silver Ores.—The Mississippi State Building, 1 engraving.—Machine Tools at the Exhibition, 7 engravings, Bolt Cutter, Boring Machine, Drilling and Chucking Ma-Machine, New Vise, Cutting Lathe, Power Press.—The Baldwin Locomotive Works Exhibit, 1 engraving.

II. ENGINEERING AND MECHANICS. With 32 illustrations.—Steel Railway Cars, 1 engraving.—Steel-Making Immigrants.—A New Road Pavement by M. K. COUZENS, C. E.—Building Associations in Philadelphia.—Paul's Process for Gold and Silver Ores, 1 engraving.—Casson's New Gas Furnace for Slack, 1 engraving.—Muir's New Street Railway Car, 2 engravings.—Effect of Railways on Material Progress.—Waterworks, Ancient and Modern, 26 figures.—On Fly Wheel Accidents.—Geographical Stadiometer, 1 engraving.

III. TECHNOLOGY. With 13 illustrations.—Cutting Tools for Lathes and Planers, by JOSHUA ROSE, 9 figures.—New Process of Sulphur Extraction.—Incubation of Silkworm Eggs by Electricity.—Anthrapurpurine.—Eosine upon Various Stuffs.—Fourteen New Dyeing Recipes.—Horse Power Pump 1 figure.—Cheap Photo Plate Holder, 1 figure.—Cheap Rock Breaker, 1 figure.—The Keely Motor.

IV. LESSONS IN MECHANICAL DRAWING, by Professor MACCORD, 1 page of illustrations.

V. ELECTRICITY, LIGHT, HEAT, SOUND, ETC.—Illumination by the Electric Light, 1 engraving.—Conduction of Electric Currents.—Infra-Red Portion of the Solar Spectrum.—New Apparatus for Producing Electric Discharges.—Radiometer Experiments.—Nature of the Zodiacal Light.—Electricity as a Motor.—Chutaux's Electro-Motor.—Electrical Vortices, 3 figures.

VI. CHEMISTRY AND METALLURGY.—Roscoelite, a Vanadian Mica.—Paradol.—Methods of Chemical Decomposition, by Professor GLADSTONE.—Decomposition by Electricity by Chemical Affinity, by Heat.—The Copper-Zinc Couple.—Nitrates in Water.—Union of Chloral Hydrate and Camphor.—Infusoria and Nitrates.—Temperature and Solidification of Sulphur.—Erythrogen.

VII. NATURAL HISTORY, MINERALOGY, ETC.—Borax, Sulphur, and Quicksilver Deposits in California.—New Meteoric Mineral.—Magnetic Native Platinums.—Melanophlogite.—The Agouti, 1 engraving.—New Sponge from Yucatan, 1 engraving.—The Rowton Siderite.

VIII. MEDICINE, PHYSIOLOGY, HYGIENE, ETC.—Vaso-Motor Nerves, New Experiments.—Fuchsine Poisons.—Variations of Inter-Cranial Pressure.—Aspartic Acid.—Prizes for Safety Suggestions in Industrial Occupations.—Diphtheria, Recent Improved Remedies.—Sulphide of Calcium, Remedy for Glandular Swellings, Boils, etc.—Chloride of Soda for Cancers.—DR. JEANNEL'S Multiple Antidote.—Preservation of Ice at the Bedside.—Vaccinated Cattle Saved.—The Brussels Hygiene Congress (over forty subjects of enquiry).

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AMERICAN CONTRIBUTIONS TO THE DEVELOPMENT THEORY.

The address which has deservedly attracted the greatest share of attention, out of the many learned essays delivered at the recent meeting of the American Association for the Advancement of Science, is Professor E. L. Morse's masterly summing up of all that America has done to promote the growth of the development theory. Professor Morse is an ardent evolutionist, a naturalist of great learning and ability, an indefatigable investigator, and, like most prominent men in the scientific world, has no hesitation in assuming the offensive in support of doctrines of the truth of which he is deeply convinced. Hence there is nothing resembling trimming in his discussion of the evolution question, the opponents of which receive scant mercy at his hands; but still very many of those whose scientific faith is thus attacked are among the Professor's warmest admirers, for he possesses the happy faculty of being always instructive, always original, and of lifting his topics out of the slough of technical pedantry in which too many of our learned scientists seem over inclined to bury modern acquisitions to our knowledge, especially of natural history.

Professor Morse tells us that the first clear premonition of the doctrine of natural selection came from an American, William Charles Wells, borne at Charleston, South Carolina, in 1757. In 1813 Wells read a paper before the Royal Society, in which he attempted to account for the color of dark-skinned races of men by citing the changes of animals under domestication, showing that varieties of men and animals were occurring, not exceptionally, but constantly, and that different breeds of animals were thus obtained by man's selective supervision. Hence he argued that a similar selection among men had been effected by the comparative immunity from certain diseases of those who had dark skins. This is substantially a part of the theory of natural selection now expanded by Darwin and credited wholly to him; but the verdure of originality, it seems, must now fade from the English naturalist's laurels. The honor belongs to an American inventor, who, like hundreds of his brethren since his day, has furnished the thoughts whence have sprung some of the most noted of foreign "discoveries." This is unquestionably the most important fact broughtforward in Professor Morse's paper, and it will provoke universal comment.

Classifying the work of various American investigators, Professor Morse tells us that in producing new evidences for the doctrine of natural selection, Drs. Burt G. Wilder, Englemann, and W. K. Brooks and Professor Charles V. Riley have borne distinguished parts. Professor Riley's proof of the inter-dependence of flower and insect in the case of the yucca moth is a scientific triumph. The late Professor Jeffries Wyman completely ruined the beautiful theory that the cells of bees were of such construction as to use space and material to the best possible advantage. He found by close study that the cells of all cell-making insects are of all grades, from shapeless masses to those which approach but never reach perfection. The late Professor Chauncey Wright also did admirable work in showing that the arrangement of leaves of plants along their axis, was due to circumstances of growth, and was not a circumstance of blind law.

Professors S. F. Baird, J. A. Allen, and Robert Ridgway severally have found that marked differences in birds and mammals are due solely to their surroundings. Thus, for example, Western birds have longer tails than Eastern ones of the same species, and on the Pacific coast birds acquire a darker hue. Large numbers of like changes, when tabulated and shown on a geographical chart, were found coincident with variations already ascertained in the amount of rainfall in the different regions. The total number of species of birds was reduced about one fifth by these investigations, and the number of species of squirrels decreased one half or more.

As evidences of the transmutation of species, Mr. James Lewis has discovered that a truncate form of mussel, which, by the loss of one of its segments, had been distinguished from another form, takes its peculiar shade from the circumstances to which it had been exposed, namely, the abrasion of its edges and consequent retarding of its growth in the rapid currents of the Mohawk River. Mr. A. G. Wetherby has called attention to changes in snails under like conditions; and Dr. Cooper and Messrs. Stearns, Bland, and Birney, have all described instances in which changes in animals have followed altered circumstances of heat or moisture. Among the examples of the survival of forms by adaptation to changed environment, the discovery by Mr. Ernest Ingersoll of marine mollusks and living salt water crabs, high up on the Rocky Mountains, is the most remarkable. Professor Marsh has made a series of brilliant researches concerning the siredon, an animal of the salamander kind, that loses its gills, and becomes, when removed from its natural habitat, one previously recorded under an entirely different genius (*amblystoma*). The researches of Drs. Packard and Putnam have overthrown Agassiz' theory that the blind fish of the Mammoth Cave are of a race created in their present condition by showing that a whole series of fishes, ranging from those with perfect eyes to those without any, including between them various deficiencies of vision, have been found in American caves and secluded waters. The discoveries of Professors Leidy, Marsh, and Cope, among the tertiary mammals of the West, have filled wide gaps between older and existing forms, showing all the intermediate animals, so that we have nearly the whole ancestry of the horse, back to the five-toed animal, not larger than a fox, in the eocene period.

The remainder of Professor Morse's admirable address sets forth the present theories of Darwin and the evolution school, and more especially dwells upon the gradual development of the intellect of animals. The earliest mammals had the smallest brains; and as we go upward in the strata, the size of the brain gradually increases. Its development in the monkey tribe was regarded as the means by which these animals were enabled to escape from the carnivora which formerly abounded; and intellect even in that early era thus proved its superiority to brute force.

In his conclusion, Professor Morse showed how perfectly the evolution doctrine accounts for the fatalism of the Turks, the cruelties of savages, and the outrages generally among civilized people, attributed to the total depravity of humanity. He considers all such manifestations as simply relapses to the savage nature which we all inherit from animal progenitors; and that where such relapses in any individual become constant, it is the duty of society to treat that individual practically as it would a dangerous beast, and so govern him as to prevent his propagating his kind.

THE COMING EXPLOSION AT HELL GATE.

General Newton has recently stated that the great explosion at Hell Gate will take place during the latter part of September. The excavations have been complete for some time past, but delays in passing the appropriation bill by Congress checked further operations, and for this reason the blow-up did not occur on the 4th of July, as for a long period was contemplated. Those who expect to witness a gigantic column hurled hundreds of feet into the air, or look forward with some trepidation to the effects of fearful concussion on adjacent buildings, will hardly find their anticipations realized. The mine will be flooded previous to the explosion; and with the possible exception of jets forced through seams in the rocks, there is no reason to believe that any very remarkable exhibition of the tremendous force of the explosives will be manifest. From a scientific point of view the occasion will be of considerable interest, as the earth in the vicinity will be shaken by the communicated vibrations, which are likely to travel over a long distance. An opportunity will thus be afforded for measuring the velocity of sound waves through earth, and preparations are being made by scientific men to observe the same at points at distances 200 and 300 miles away.

The arrangements to guard against any possible danger are being perfected, in utter disregard of the desires both of those who hope to see the great blast, and those who aspire to profit pecuniarily through the popular curiosity. Steamboats and other craft will be warned away, so that a view from the river will be out of the question; the authorities have been requested not to grant passes to would-be spectators on Ward's Island, the best point of observation; and a bluff of earth and the buildings near the works prevent seeing the operations from the rear, so that the expectant populace will probably have to satisfy themselves with a distant view from the high land on the New York shore.

How much powder, etc., will be burnt is not yet definitely stated. An approximate idea of the quantity may be gathered from the fact that there are about 4,000 drill holes, each 3 inches in diameter, and varying from 7 to 13 feet in depth. Each will be charged with a separate canister of dynamite, vulcan, and rend-rock powder, and the simultaneous explosion will be effected by the current from a battery of 800 cells. About two pounds of powder are used to one of dynamite, and the charges are inserted in the 172 piers of rock and in the roof supported thereby. It is estimated that 30,000 cubic feet of broken rock will be left under water, and this will have to be removed by dredging so as to secure a channel 26 feet in depth. The total length of tunnels, galleries, etc., excavated, is 7,425·67 feet. The amount thus far expended is $1,686,841.45.

CHEAP COAL.

The breaking up of the coal combination and the consequent throwing upon the market of half a million tuns of coal is a welcome event. The whole coal trade of the East has, for several years, been under the absolute control of a monopoly which has signalized its sway by unwaveringly maintaining high prices, without regard to the demand first, or the depressed condition of all business affairs. It is characteristic of the patience of our people that no means have been tried to mitigate this condition of things; but now that the crisis has come, it is like a gleam of sunlight through the black shadows which have fallen across the prosperity of the industrial world. When coal is once more subject to the natural laws of trade, and not until then, will its traffic rest on a sound basis; and when this comes to pass, then we may look for a revival in iron manufacture, and in all the industries in which steam is used. Too many people are undergoing the effects of long existing business stagnation not to watch eagerly for any sign, however faint, indicative of better times, and therefore the gratification felt and openly expressed, at the collapse of the combination, is undeniably great. One public sale of 500,000 tuns will not affect the whole winter's trade, however, any more than one cold day represents the whole winter's weather; but as matters now appear, the present event is only a beginning, and predictions are freely hazarded that we shall see still lower prices.

The fall in rates at the late auction seem to have astonished every one, and none more than the coal dealers themselves. The reduction from the combination schedule for August averages about $2.10 per tun, and average prices ranged from $2.20 for Philadelphia & Reading chesnut to $3.86 5/10 Delaware & Hudson stove. The Vice-President of the Pennsylvania Coal Company asserts that it would cost $500,000 more to mine the coal than the prices fetched at

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the sale amount to. The agent of the Delaware & Hudson Canal Company counts up the various expenses of handling, mining, commissions, etc., and claims that a tun of coal costs at tide water $4.15, while the average at the sale was but $2.42. In the coal regions, the operators say that either tolls and labor must be greatly reduced or they must suspend operations. Miners' strikes are feared, and altogether the prospects are gloomy for both laborers and owners.

THE SCIENCE OF MECHANICAL MOVEMENTS.

There are numerous treatises devoted to descriptions of great inventions and discoveries, and discussions of the processes of reasoning by which they were worked out. It has long, too, been recognized that there is such a thing as scientific invention, in which the mechanic, having definitely determined the result which he wishes to attain, proceeds to achieve it by a series of systematic steps. It is true that the genius for making discoveries, with which some men are endowed, gives them a great advantage over their fellows; but it is equally true that genius, properly directed, is far more certain of success than if it acts without a guide. This is sufficient to account for the great interest which has been taken in the matter by professional writers, and the number of treatises relating to it that have been published. Few of these works, however, go farther than to show the nature of inventions that have already been perfected, and to give discussions of the motions that are produced. It is a great advance when a writer offers to the public a method which is capable, not only of analyzing all existing mechanical movements, but also of furnishing the outlines of any movement that may be desired. This is the claim made by Professor Reuleaux in his "*Theoretische Kinematik*," a work which has excited great interest in Germany, and has recently been translated into English. Professor Reuleaux' method of analysis possesses the merit of great novelty, and a description of its nature may be received with favor by readers of an inventive turn of mind.

The reader who is familiar with analysis knows that the discussion of an equation is a very thorough method of determining all the conditions and variations of a given question. The well known problem of the lights, which is to be found in most elementary treatises in algebra, is a good example of this kind; and still better illustrations will occur to the reader in the discussions of some of the equations deduced in what is commonly known as analytical, but more correctly as general, geometry. A somewhat similar plan is adopted by Professor Reuleaux in his *Kinematik*. All ideas of force and time are disregarded in the consideration of a mechanism, and he merely concerns himself with the motions that are produced. The geometrical methods of determining changes of position are explained; and the nature of simple mechanisms and the manner of compounding them are fully illustrated. This part of the work may be compared with the introduction to the study of algebra, in which the idea of generalization is first presented to the student. Then the notation by which mechanisms are to be represented is introduced. The system adopted, which is entirely novel, cannot be properly explained in a limited space, but some of its characteristics may be noted. The different elements of a machine, such as screws, prisms, cylinders, cones, etc., are indicated by appropriate letters, accented in such a manner as to show whether they are hollow or solid. Letters connected by a dotted line indicate that the two elements are joined by a link, a comma shows connection by contact, an underscoring of a dotted line stands for a fixed link, an elastic link or spring is marked by a wavy line over the dotted one, etc. The notation is by no means complex, and can be mastered in a short time by any one who is accustomed to the use of algebraic symbols. It will be a surprise to many to find that the elementary parts of mechanism are comparatively so few in number. The use of the notation having been illustrated by numerous examples, properly graded, the author proceeds to the final analysis of mechanisms, or discussion of the expressions given by the notation. This is, of course, the object of the whole work, to which all that has preceded has been only preparatory. The reader who has followed the description so far cannot fail to see that the method seems to show the possibility of a thorough analysis of any mechanism that can be included in the notation. Those who feel an interest in rotary engines (and few engineers have not designed at least one of these machines) will find that this class of machines has been pretty thoroughly analyzed by Professor Reuleaux. The work is by no means exhaustive in every field of mechanical movements, but is rather intended to furnish the investigator an instrument which he can use in his own explorations. Even those who do not care to study the work thoroughly can scarcely fail to gain some useful ideas from turning over the pages and inspecting the sketches of the various movements shown.

SOME NEW LIGHT ON THE ORIGIN OF THE TRUFFLE.

The truffle is a species of underground fungus largely used in French cookery to give a peculiar rich flavor to meats. It comes principally from France, where it is always found in oak or beech woods, and can only be gathered through the agency of the keen scent of dogs or pigs especially trained to hunt for it. Both from the difficulty of obtaining the fungus, and from the fact that it is a delicacy highly prized by epicures, it brings in all markets a large price; and thus truffle hunting has long been a remunerative calling for the French and Italian peasantry. In appearance, the truffle is a blackish mass, covered with protuberances and weighing from an ounce to several pounds; when cut open it presents a marbled appearance, and its reproductive portion (it is sexless) is found in the veins in the shape of minute sacs which never open, each containing several spores, possessing spine-covered or honeycombed surfaces.

Numerous attempts have been made to cultivate these fungi, but with little or no success. Regarding their early development, comparatively nothing has been known, and the spawn or vegetative portion, which, in the case of the mushroom, is readily obtained, allowing the cultivation of that fungus to any degree, has not yet been definitely found in the truffle. Sprinkling the earth with water, in which the parings of truffles have been steeped, has resulted, it is stated, in producing them; and they have likewise been obtained by the slow process of planting calcareous soil with acorns and waiting for the saplings to reach a few years' growth, when the truffles could be gathered among the roots. Still no practical method of cultivating the truffle is in existence; and since they are found completely isolated from anything which could produce them, we are left in the dark as to how they are originated, or at best with merely the supposition that, at an early period of their development, they are parasites of the tree roots, or the theory that, like oak galls, they are due to the stings of insects. This last conjecture, however, arising from the fact that truffles are attacked by dipterous insects, like other nitrogenous cryptogams, has been refuted by the entomologists.

A very curious and recent experiment by M. Brefeld throws some new light on the subject, and may lead to the long sought method of cultivation. The *penicillium glaucum* is the well known green mold which appears on bread and cheese, and which owes its name to the fact that, in free air, it consists of chaplets of spores, in brush form, connected to a stem or pedicle. The mode of reproduction of this mold depends on the medium in which it exists. Now, by placing the *penicillium* in a closed vessel with very little air, M. Brefeld has obtained nodules which, after being buried in moist sand, fructify with internal *asci* which do not open. That is to say, they are produced in a manner analogous to truffles. The *asci*, we may explain here, are the little sacs in which the spores are contained, and are found in many complex forms of fungi, which build up a special organ called the *peridium* to hold these sacs.

It will be seen from M. Brefeld's discovery that he has noted two forms of green mold, one aerial, or *penicillium*, the other existing when partially deprived of air, or tuberaceous. The truffle through its subterranean location is always in confined air, present besides in limited quantities, and in that state is sexless. Now it remains to find its aerial form, to discover the peculiar *penicillium*, which placed under the conditions noted will produce, for its nodule, a truffle.

IS BROTHER JONATHAN SO VERY SLIM?

In our examination of the newly published medical statistics of the Provost Marshal General's Bureau of the late war, with regard to the relative hight of American men, we had the pleasure of showing, the other day, that the native born among our citizens and soldiers stood first in point of stature; while in every instance the foreign born exceeded the stature accorded them in the statistics of the nations they represented. We not only raise the tallest men, but draw from foreign countries, by emigration, men of more than average stature.

The artists are therefore quite right in always depicting the typical American, Brother Jonathan, as very tall. But they also make him very slim; and theorizing travelers have never hesitated to give a reason for his being long-legged and lank. One blames the climate; another, tobacco; another, bad cookery; another, his excessive "push" and eagerness in business; while the extra scientific Buchner was sure that the continent was altogether unfavorable to the European type of man, and would allow us no alternative but extermination or a speedy approximation to the Indian type. But is the average American really so slab-sided and lean?

Let us see what answer our statistics give. How do we compare with other nations in girth and weight? As statistics of mean weight have but little value apart from measurements of hight and girth, and age, we will first examine the records with regard to the degree of maturity of the several racial elements of our armies.

From the statistics gathered by the Sanitary Commission, Gould found the mean age of 1,012,273 men of all nativities, mostly volunteers, to be 25 years and 10 months. As a careful analysis of statistics of physical development shows that American born white men do not attain their full growth until between thirty and thirty-five years of age, it is obvious that the results obtained from these statistics will under rather than over rate the average dimensions of American men. It will be seen, too, from the following table of men enlisted toward the close of the war, when the average age of recruits was highest, that, with the exception of a small number of Canadian recruits, the native born element of the army was the youngest.

Nativity.	Number.	Mean Age.
United States	196,980	26·955 years.
British Possessions	14,954	25·352 "
England	10,103	27·855 "
Ireland	30,412	27 216 "
Germany	30,943	31·029 "

Unfortunately the instructions to enrolling surgeons did not direct them to record the weight of the men examined. Only the more energetic officers took the trouble to make their work complete in this respect; consequently the statistics on this point are less full than could have been desired. Still an idea of the relative bulk of the men of the five principal nativities may be had from the following tables, showing the relation of hight, girth of chest, an expansion of chest to increasing weight in over 10,000 men of all ages from 18 to 45 years. The men, when weighed and measured, were invariably naked.

WHITE NATIVES OF THE UNITED STATES.

Weight.	Number of men.	Mean hight. inches.	Mean girth of chest at expiration.	Mean expansion of chest.
Under 100 pounds	14	64·000	29·714	3·071
100 and under 120	991	65·191	30·468	3·146
120 and under 140	2,968	66·856	31·997	3·238
140 and under 160	1,894	68·424	33·642	3·289
169 and under 180	427	69·920	34·988	3·289
180 and over	65	70·215	36·554	3·269
Total and mean of total.	6,359	67·297	32·491	3·242

BRITISH AMERICANS.

Under 100 pounds	2	64·000	30·000	3·500
100 and under 120	38	64·211	30·737	3·184
120 and under 140	304	66·546	32·020	3·247
140 and under 160	198	67·848	33·606	3·298
160 and under 180	41	69·512	34·439	3·402
180 and over	6	69·333	35·333	3·333
Total and mean of total.	589	67·059	32·666	3·272

ENGLISHMEN.

Under 100 pounds	0	——	——	——
100 and under 120	56	64·067	30·893	3·107
120 and under 140	243	65·835	32·453	3·154
140 and under 150	128	67·625	33·609	3·242
160 and under 180	25	68·480	34·960	3·380
180 and over	2	69·000	38·000	3·500
Total and mean of total.	454	66·348	32·749	3·187

IRISHMEN.

Under 100 pounds	3	62·667	30·667	2·167
100 and under 120	158	64·532	31·519	3·215
120 and under 140	724	66·119	32·715	3·181
140 and under 160	450	67·609	33·916	3·233
160 and under 180	74	69·270	35·357	3·338
180 and over	8	69·000	36·750	3·250
Total and mean of total.	1,417	66·589	33·119	3·208

GERMANS.

Under 100 pounds	3	63·333	30·000	2·833
100 and under 120	168	64·167	31·357	3·262
120 and under 140	675	65·532	32·601	3·226
140 and under 160	389	66·905	33·969	3·231
160 and under 180	104	68·346	35·192	3·221
180 and over	4	69·000	36·000	3·500
Total and mean of total.	1,343	65·985	33·047	3·231

Taking into account the relative youth of the American element of our armies, and the probable inferior age of the Americans furnishing the foregoing measurements, their slight inferiority in girth of chest is not at all remarkable. It certainly does not indicate any excessive lankness in the natives of this country.

Dr. Baxter has compiled a table exhibiting the mean results of a great number of sets of observations by various authorities. Most of them are too fragmentary to be of use in this enquiry; but such as are complete as regards age, hight, girth, and weight, we have brought together in the following table: Though not sufficiently complete to warrant any sweeping generalization in regard to Brother Jonathan's physical qualities, it carries evidence enough at least to satisfy one that the typical American is a fair specimen of humanity, in bulk and weight, as well as in stature.

Nativity.	Mean age. Years.	Mean hight. Inches.	Mean cir. chest. Inch	Mean weight. Pounds.	Authority, etc.
United States	24·01	67·36	——	148·29	Coolidge: 1,537 recruits.
	23·94	67·05	34·99	147·50	Elliott: 1,700 army of Potomac.
	25·62	67·34	34·43	144·83	Gould: 8,349 volunteers.
	——	67·22	35·69	142·80	" " 12,757 "
	26·39	67·30	32·49	136·05	P. M. G.'s Bureau: 6,359 recruits.
British America	24·94	67·06	32·67	138·69	" " 589 "
England	24·31	——	——	148·41	Coolidge: 3,439 U. S. soldiers.
	24·00	65·94	——	138·46	Dawson: 1,500 civilians.
	27·36	66·35	32·75	135·64	P. M. G.'s B.: 454 recruits,
Scotland	28 to 45	67·72	——	148·69	Beddoe: 1,982 civilians and soldiers.
	25·00	68·30	——	144·03	Forbes: students.
	18 to 45	67·07	33·84	——	P. M. G.'s B.: 3,476 recruits.
Ireland	26·80	66·59	33·12	136·46	" " 1,417 "
	23 to 45	——	——	137·98	Beddoe: 1,616, nearly all soldiers.
France	30 50	64·84	34·61	143·20	Bernard: 400 infantry of guard.
	30·—	66·10	35·43	141·10	Allaire: 730 cavalry "
Germany	30·10	65·98	33·05	136·48	P. M. G.'s B.: 1,343 recruits.

It will be seen that the average American compares very favorably with the best specimens of the race, the English and the Scotch, as regards bulk and weight. The most extensive series of observations on this head ever made in Great Britain are those of Dr. Beddoe, who collected measurements of over 17,000 civilians and soldiers, between twenty-three and fifty years of age. From these he calculates the mean hight of Englishmen to be 5 feet $6\frac{6}{10}$ inches, and that of Scotchmen 5 feet $7\frac{1}{2}$ inches. From the careful measurement of one half a million men, little and big, sick and well, by the Provost Marshal General's medical staff, it appears that the average hight of the men of eight of our Northern States exceeds 5 feet 8 inches. In sixteen States, the average exceeds that of the Scotch; and in one State only (Connecticut) does it fall so low as that of the average Englishman.

In the matter of bulk, the comparison, as we have seen, is not less favorable to Brother Jonathan. He is as heavy as the heaviest even in his youth: and the apparent slimness of his immaturity, due to his superior hight, is fairly made up for by the time he reaches his full development.

ARTIFICIAL TEETH.—Mr. Merrick Bemis, of New Haven, Conn., desires us to state, that his patent (which we quoted on page 106, volume XXXV, and which states that the plates are intended to fit over natural teeth, and in which the teeth are described as all molars) covers the application of the invention to all teeth.

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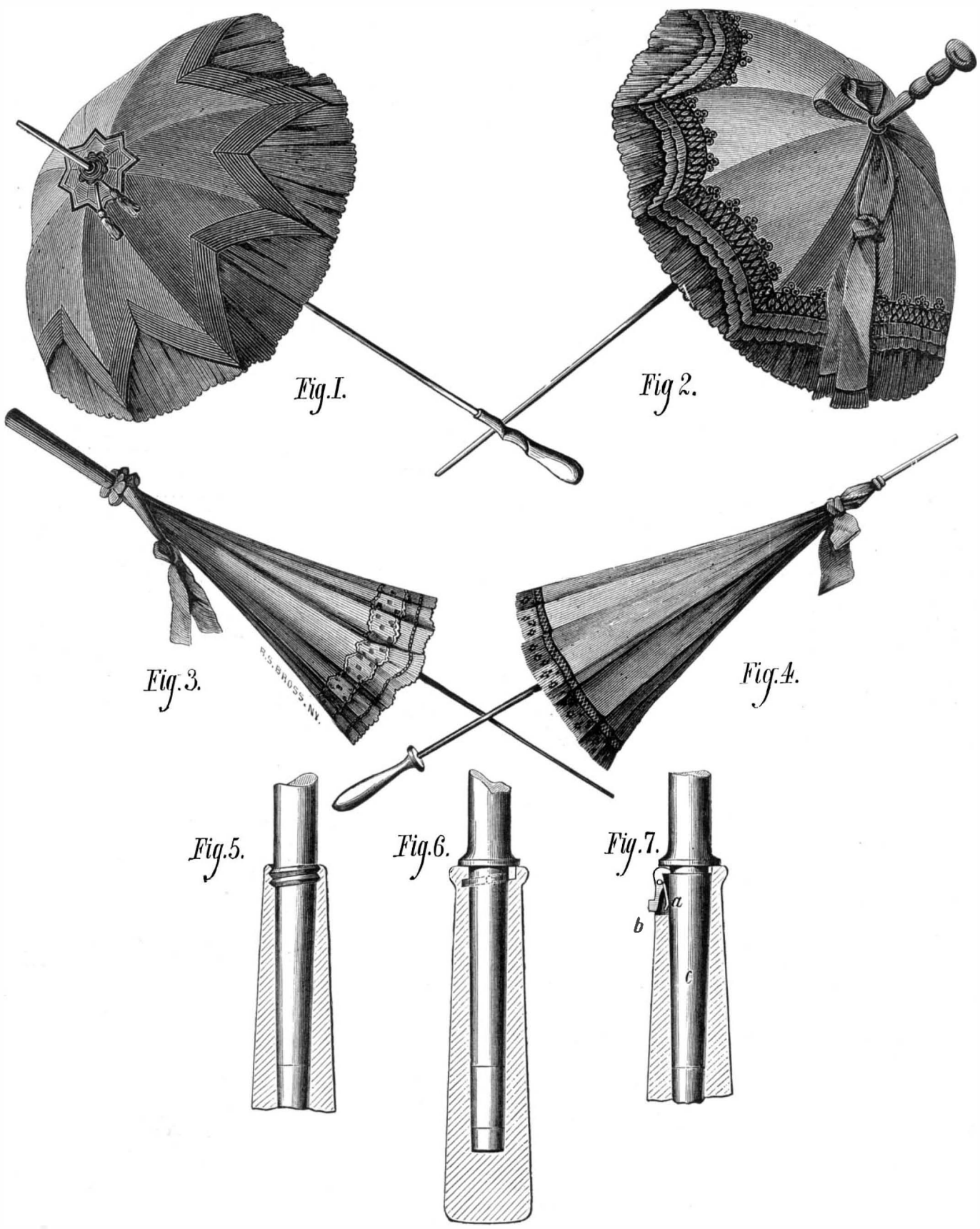
THE DETACHABLE HANDLE PARASOL AND UMBRELLA.

The annexed engraving illustrates a novel, simple, and useful improvement in this staple article of trade. The invention may be described either, *firstly*, as an improvement on the common style of parasol or umbrella, where the handle is at the "right" end of the stick, as seen in Figs. I and IV; or, *secondly*, as an improvement on the walking-stick or Alpine style of parasol, where the handle is at the "wrong" end of the stick, as seen in Figs. II and III.

The invention consists in making both ends of the stick alike, and in providing a detachable handle, capable of fitting on either of said ends; so that a lady can adjust the handle at pleasure, on either end of the stick, as quickly, and with as much ease, as she could expand or close the parasol.

The invention is, *first*, an improvement on the common style of parasol or umbrella (Figs. I and IV) in respect that—the handle being reversible — the improved article combines in itself the two styles, namely, the common and Alpine; in short, the improved parasol can be adjusted to either of the *four* different positions represented in Figs. I, II, III, and IV. Secondly, the invention is an improvement on the walking-stick or Alpine style of parasol (Figs. II and III) in respect that it effectually overcomes the objections to the Alpine style, which are these, namely, that the lady must, when desiring to hold the parasol overhead, take in the hand that end of the stick which had previously been in contact with the not-over-clean sidewalk, thus rendering the hand or glove liable to be soiled; and that, when being so held overhead, a substantial hold for the hand is not afforded, the parasol having to be held by the slender stick alone. A glance at the engravings, however, will show that, in the improved parasol, these two objections are effectually overcome; for the handle, as it has been seen, can readily be changed from one end of the stick to the other.

Fig. VI shows a plain handle, in section, containing an end of a parasol stick, and secured to the stick by a bayonet joint. Figs. V and VII are modifications of the same, the handle in Fig. V being secured by a screw, and in Fig. VII by a spring-catch. In Fig VII the spring, *a*, pressing against the end of the stick, *c*, throws the tooth of the catch into the shallow groove in the stick and holds it in that position till released by pressure of the thumb on the knob, *b*. The above methods of securing the handle, however, are shown merely as a few of the many ways of doing so, the Patent allowing the handle to be secured to the stick by any suitable fastening device.



THE DETACHABLE HANDLE PARASOL AND UMBRELLA.

Regarded, then, as an improvement on the common style, or as an improvement on the Alpine style of parasol, the invention presents the following merits and advantages—it combines, in one article, the common and the Alpine styles; it effectually overcomes the objections to the Alpine parasol; and, further, it allows a lady, when choosing a parasol, to select also a handle to her taste, which can be furnished of the necessary gage. The invention is simple and effective; and, we are informed, the improved article can be manufactured at a price to compete with the unimproved article. We think the invention a practical one, and we augur for it much and lasting success.

Letters Patent for this invention were issued jointly to Messrs. George Yule, and William M. Henderson, of Pennsylvania, on the 24th November, 1874.

For information as to rights, licenses to manufacture, etc., address, by letter, Mr. George Yule, care of The Henderson Co., 258 South Third Street, Philadelphia, Penn.

Why Not?

"Can any one give a sensible reason why a person who devises a new and patentable idea should not secure a patent upon it? I have ransacked the entire field of opposition without discovering a single reason that cannot be demolished by one whisk of the horse tail of common sense. Granting that all patents are not profitable, we must acknowledge that the expense of obtaining them, especially in the United States, is quite moderate, and that the chance of realizing from a patent is always worth the amount it costs to secure it; and I might state, as a rule, that the exclusive monopoly of any invention for seventeen years (the term for which patents are issued) is worth the price of a patent whatever may be its character, unless it is based upon a foolish or incorrect theory, or is practically inoperative. I do not intend by this statement to be understood that every such patent will yield a fortune, or even an independence for its owner, but that as an investment of so much money it cannot be regarded as a bad investment. Apathy, or rather a failure to properly put the patented article upon the market, and exaggerated ideas of its value, which lead to exorbitant demands from any one who might desire to purchase, are the principal causes of inventors failing to realize from their patents. Many patentees prefer to let their patents lie un introduced rather than dispose of them at sensible prices, when often these figures would yield a fair profit. Many a good patent is buried and forgotten until it runs out, and then some one, more sensible in such matters, as likely as not picks up the idea, manufactures the article, puts it upon the market, and grows wealthy upon the profits. Again, how often is it that we run across persons who regret that they did not secure patents upon their inventions or discoveries when they first made them. Many an originator of an idea has failed to secure himself by a patent when he might have done so, and has seen his ideas appropriated, and the invented device finally become a standard article of commerce and trade. As likely as not, the dilatory individual spends the balance of his life in useless regrets that he missed a chance for securing a competence and probably a fortune. It was a neglected opportunity not only to become rich but to enroll his name among the list of men of genius. A few such instances as these are necessary and valuable to point a moral to our tale. Their experience is a living example to other inventors, and is one of the strongest arguments to support our 'Why Not?'

"Again, leaving profit entirely out of the question, a patent is a national record of the genius of the people, and every man who can do so should be proud to have his name placed upon the record. Is it not a fact that we feel a glow of pride when we run across the name of some ancestor among the names of patentees in the patent record? We at once feel that we have inherited the national Yankee characteristic of an American, and we grow tenderer and more sympathetic with our next door neighbor who has been spending all his time and money for years in a vain endeavor to invent a perpetual motion machine. It is the only chance a great many of us have to send our names down to posterity linked with a noble and public ambition to help ourselves and the world along. If the invention does not promise to be speedily remunerative when it is made, it should be patented nevertheless, as we do not know how soon the necessity may arise that will call for such a device. Most of the devices which the originators failed to patent and which afterwards went into general use have just such a history.

"Many people are so constituted that they never pay out a dollar unless they see an immediate prospect of two dollars being returned for it. Such persons will most generally miss the main chance and have the pleasure of regretting their folly ever afterwards. I therefore ask again, why not patent your inventions? And I am sure every sensible person will reply 'why not?'"—*Mining and Scientific Press.*

Errata.

Messrs. S. C. Forsaith & Co., Manchester, N. H., desire us to correct an error in the description of their hand fire engine, published on page 127 of our current volume, by stating that four men, instead of fourteen, were able to throw a half inch stream 186 feet, instead of 156 feet, as printed on the page referred to. The initials of the patentee, Mr. Hall, are J. M., not A. M.

Messrs. J. A. Fay & Co.'s planer, matcher, and beader, illustrated on page 147, current volume, was entitled, by a typographical error, a planer, matcher, and bender.

THE value of the Centennial buildings is put at $5,949,000, and of their contents, $104,820,340. A large portion of the exhibits, which are not taken into account, are not of intrinsic value, though probably they could not be purchased for all that the rest of the exhibition is worth.

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HANGINGS FOR SLIDING AND SWINGING GATES.

The invention herewith illustrated is an improved attachment, or iron, for that class of gates which are opened by sliding them back upon a proper bearing surface in the gate post until a balanced position is reached, and then swinging them round upon the bearing as a center. The device is composed of two cast iron brackets, a transverse slotted swivel, and a bearing wheel, all as shown more clearly in Fig. 2. The brackets, A, are provided with projectionshaving suitable bearing openings for the iron which revolves therein. The projecting portion of the brackets, it will be observed, extends in a diagonal direction from the face of the post. The bearings are thus adapted to permit the iron held thereby to lie parallel to the side or face of the post, as may be desired. The swivel iron, B, consisting of a casting provided at each end with bearing studs. rests in the bearing openings of the brackets and turns therein. The bearing wheel, C, the circumference of which is less than the inner circumference of the circular opening in the swivel, is provided with journals which rest upon bearings at the bottom of the vertical slots.

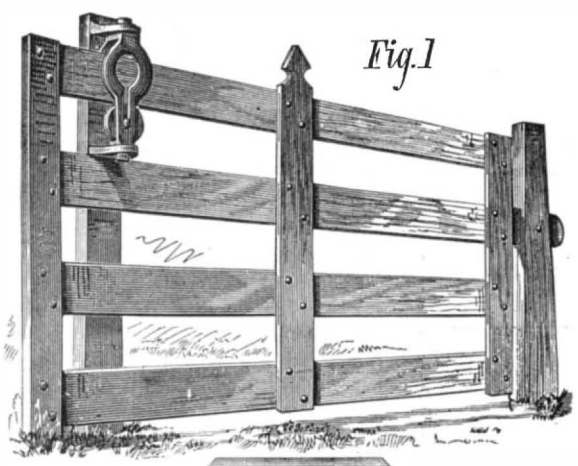


Fig. 1

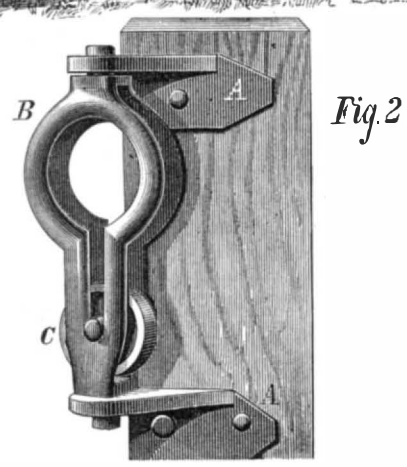


Fig. 2

The gate, Fig. 1, is constructed as desired, and one of its bars is held in the slot, passing through the swivel iron and resting upon the bearing wheel. The operation of the gate is similar to others of its class already noted. It is closed, of course, by the opposite movement. Some of the advantages claimed for the described construction are as follows: By constructing the iron with the large circular opening and vertical slots, the bearing wheel may be readily inserted in its place and be securely held there without the necessity of drilling journal holes or inserting pins. The extended bearing surface, also furnished by this form of casting, serves to hold the gate bar always in line with the bearing wheel, so that the tendency to cramp or pinch when the gate is longitudinally moved is avoided. The attachment as a whole is strong, durable, and simple in its construction, it being complete and ready for use when cast, without drilling or finishing of any kind, so that it can be made at a small cost.

We are informed that farm gates put up with this device need no bolting nor bracing; and as they rest with each end squarely on the gate posts, they will neither warp nor sag. They can be raised up so that sheep or hogs can pass under them. The gate may also be placed on the side of a steep bank or over snow drifts.

This invention was patented July 25, 1876, by Elias Shopbell, of Floris, Iowa, by addressing whom further particulars may be obtained.

Coal Dust as Fuel.

The use of dust and pea coal has been thoroughly tried at the Ocean Mills, Newburyport, Mass., for the past year and a half, with the following result: For years they have kept an actual account with scales of every barrow of coal wheeled into the fireroom,and the average weekly consumption shows forty tuns of broken coal on 18,000 lbs. of cloth, average costing $7 per tun, or $280 per week, which makes the cost of fuel per pound of cloth over 1½ cents; under the present arrangement, the weekly consumption is only thirty-six tuns of pea and dust on 20,000 lbs. of cloth, costing $3 50 per tun, or $126 per week, which makes the cost of fuel per pound of cloth less than six mills, showing a saving of nearly one cent per pound. This mill is run entirely by steam, and the cost of one and a half cents per pound in burning large coal does not vary from the cost of other mills in the same vicinity. Beyond the saving of fuel, the fire is much easier on the boilers, brickwork, and fronts of furnaces, no repairs having been made on any of the above since the arrangement was put in; and the grates are as perfect as new. This one item almost pays the expenses of the arrangement. The labor is not near as hard on the firemen, and the engineer has the steam under entire control. Again, if steam is drawn down rapidly, as in dye works, it can be brought up again in a quarter of the time.

The want of market for dust, heretofore, has caused its being dumped off on to the dirt piles at the mines at a much greater cost than if loaded into cars; and the accumulation at the shipping ports has been of such inconvenience that thousands upon thousands of tuns have been dumped under the docks to get rid of it. Much of the pea coal has been thrown, also, upon the dirt piles, all of which will now be carefully saved, and shipped to market, the present arrangement developing more steam from one tun than we got from the same quantity of any larger sized coal.— *Boston Transcript.*

Action of Impure Rain Water on Lead Pipes.

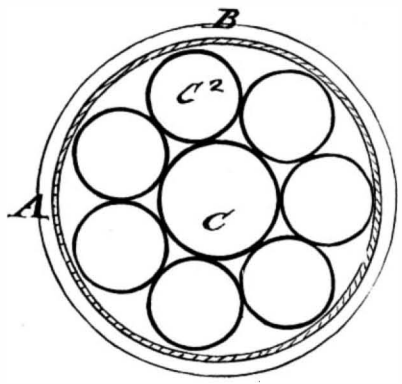
In a paper lately read before the American Chemical Society, Professor Paul Schweitzer says: The laboratory of the University of Missouri is supplied with rain water, which collects in a tank in the upper part of the Scientific Building,and is carried to the working tables of the students by lead pipes, which are furnished by brass stopcocks. In using this water for ordinary analytical work, as, for instance, saturating it with sulph-hydric acid, it was soon found to be unfit for such purposes, on account of the quantity of metals it had dissolved, after standing in the pipes only a short time. It is a well known fact that pure water attacks lead much faster than water containing a certain quantity of mineral salts, and this seems to be also the case with rain water, which contains invariably ammonia, nitrous and nitric acid: some sulphuric acid was also found in this water, derived from the smoke and cinders which fall on the roof of the building from the coal fires that heat the rooms. The following quantities of metals were found in one United States gallon,231 cubic inches,of the filtered water, that had stood in the pipes for one month: 1·079 grains metallic zinc, 0·537 grains metallic iron, 2·503 grains metallic lead, 0·082 grains metallic copper, 0·049 grains metallic arsenic. Total, 4·250 grains.

Arsenic, copper, and probably iron, are derived from the lead pipe, manufactured from an inferior quality of lead, and zinc from the lining of the tank. In supplying private houses or institutions with water through a system of pipes, care should be taken to find out whether the water to be supplied be pure or not: in the former case, and when rain water is the source of supply, as it is in many sections of our State, lead pipes should be discarded, and tin-lined lead pipes substituted for them.

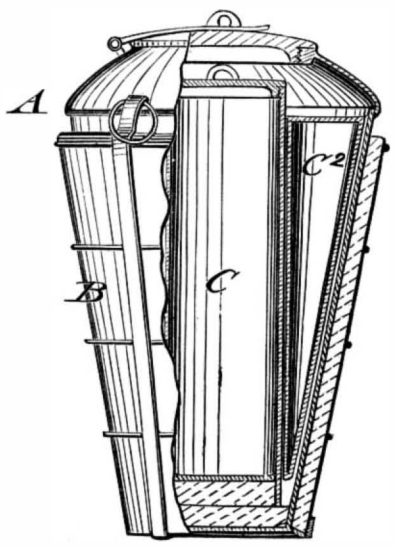
A MARINE SAFE.

Few of the great ocean steamers now leave our ports without carrying large amounts of bullion and specie. In case of the wreck of the vessel, this precious freight is likewise lost, since its weight and that of the heavy safes in which it is inclosed necessarily carry it to the bottom when the ship breaks up. Sometimes, and of course only when the disaster occurs in comparatively shoal water, a buoy is attached to the safe, and the latter, if time permits, is thrown overboard. The location of the buoy then marks that of the sunken safe, and it is not difficult to regain the latter.

A much better plan than this, and one that is well worth the attention of ship owners, insurance companies, and others, has lately been patented through the Scientific Ameri-



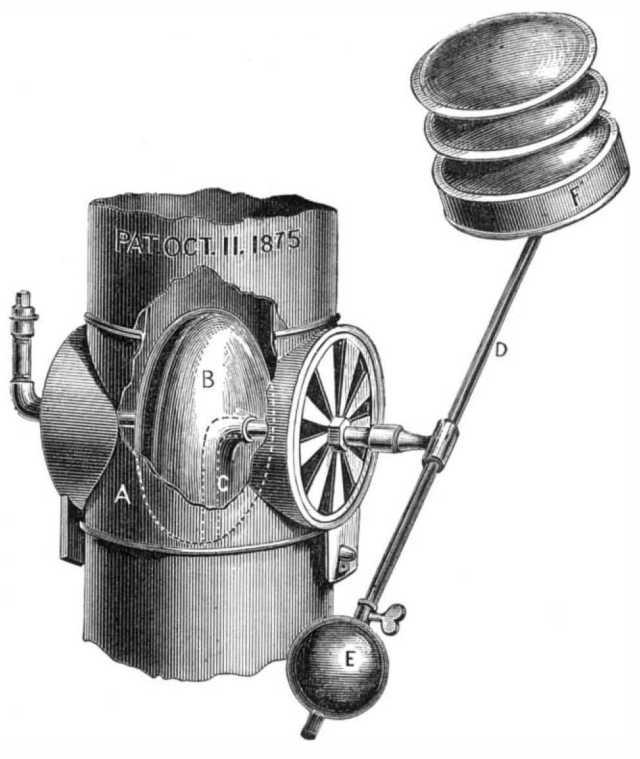
can Patent Agency (August 1, 1876) by Mr. J. L. Gouley, of New Orleans, La. This inventor proposes to make the safe itself a buoy, in the manner exhibited in the annexed engra-



ings. A is a sheet copper vessel, the lower part of which, B, is covered with rubber so as to resist the shock of being tossed on breakers. Inside the vessel, A, are a number of compartments, those marked C^2 being hermetically sealed and containing only air, while the center one, C, is designed for the reception of treasure. There are two covers· one for the center compartment, the other for the main vessel, as shown, the latter being provided with suitable locks. It is intended to mark the safe conspicuously with the name of the owners, and then, in case of wreck, throw it over board, so that, if not washed ashore, it is certain to be picked up at some time.

THE ACME AUTOMATIC DRAFT REGULATOR.

We illustrate herewith a novel and ingenious device for regulating the draft of a fire, and which also is claimed to obviate the danger arising from overheated flues. Generally, all smoke pipes are provided with a common close damper for regulating the draft. When this damper is closed, or partially so, the combustion is slow and imperfect, the gases accumulate, and when there is not a free exit they become forced into the rooms. The common damper likewise requires frequent manipulation by hand, to suit circumstances, while the present device does not at any time retard the free exit of smoke and gases, but allows them to pass into the flue as they are generated; it likewise is self-acting in its operation so far as not to require frequent adjusting and so as always to permit the necessary amount of draft for the proper combustion of the fuel.



A is a cast iron collar that fits on the smoke pipe, with double open and shut valves. B is a small cast iron boiler without joints, suspended within the pipe in such a manner and of such shape as not to impede the passage of smoke or gases. C is a siphon pipe, leading from the bottom of the boiler to the exterior lever arm, D. This lever, D, is a continuation of the siphon pipe, weighted at one end with the weight, E; at the other end it carries the metal receivers, F. It is connected as shown with the valves in the collar, A.

The action is as follows: With a moderate amount of heat passing up the chimney, the water in the boiler remains at or near the boiling point, and the valves remain closed; but as soon as the volume of heat is materially increased, steam is generated, which forces a portion of the water through the siphon pipe into the lower metal receiver. The latter then partially overcomes the weighted end and the disk descends, partly opening the air valves in the smoke pipe, admitting a current of cold air which serves to reduce the force of the draft in like proportion. Any further increase in the volume of heat passing into the smoke pipe will likewise increase the steam pressure, forcing a greater weight of water into the receivers and opening the air valves wider and reducing the force of the draft to its lowest point necessary for combustion. As soon as the fire is checked and the smoke pipe cools, the water gradually returns to the boiler, reversing the action; and the draft is gradually increased until the process is again repeated. Thus the fire itself is the agent for regulating its own draft.

There is claimed to be no danger of explosion, for, as state the manufacturers, were the boiler to become red hot, the water would be forced out of it into the receivers, and cannot return again until it has cooled. Though the air valves are self-regulating, and are acted upon by the force of combustion, they can be manipulated by hand if desired, by simply sliding the weight on the arm of the lever, which will open or close the valves, as may be desired.

The device can be readily applied to any stove or furnace, where the smoke pipe is over five inches diameter, either on a vertical or horizontal pipe. Patented October 11, 1875. For further particulars address the S. J. Gold Heater Company, 93 Liberty street, New York city.

Joint Stock Maternity.

A Welsh correspondent sends to *Nature* an interesting instance of a joint stock concern in the poultry yard: "Two hens sat on, or by, one nest, and thus between them hatched one chick. They have since, for some weeks, been parading the yard, each clucking and manifesting all the anxiety and care of a true mother over this one. The hens never quarrel, or show the least appearance of jealousy or rivalry."

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Continued from first page.

moving exteriorly to the sheds of the warp, without absolute and positive connection between the shuttle and the motor, is a problem, requiring for solution something more than a mere modification of existing devices, has been apparently unrecognized. The first weaver pushed or threw the shuttle through the warp with his hands. Kay connected pickers or hammers at the end of the shuttle race with a cord along the front of the loom, and attached to the middle of the cord a handle or "picking peg;" and this the weaver jerked in one direction or the other, causing the pickers to strike the shuttle and drive it through from side to side. In the power loom, the pickers are operated by proper mechanism; but the principle on which they work remains precisely the same. The shuttle, in fact, becomes a mere projectile, entirely out of the control of the weaver during its passage across the warp. The disadvantages pertaining to this arrangement are so many and so great that the mere recapitulation of them is sufficient to excite the deepest surprise that, for a hundred and thirty years after the device was invented, during an age of progress more rapid than the world has ever before known, the skill and genius of mankind were baffled in every attempt toward reaching the radical change so obviously and imperatively demanded. And it is necessary to consider these disadvantages for a proper appreciation of the invention to which this article is devoted.

DISADVANTAGES OF THE FLY SHUTTLE.

The ordinary shuttle being a mere boat-shaped implement, it slides over the warp thread on its slightly convex bottom. It is obvious that, when hurled as it is with lightning rapidity, the friction on the thread must be excessive. This is in fact the case, and the result is frequent breakage of the warp and constant injury to the filaments of such delicate fabrics as silk, cambric, etc., so that a limit is speedily reached, in point of fineness of the goods made, beyond which the fly shuttle is practically useless. Similarly there is a limit in the width of the fabric, or, in other words, the distance the shuttle can be thrown. The wider the warp, the more difficult it is to pick, since, while it is harder to impel the shuttle, it is likewise harder to check its high momentum and reverse its motion. A still greater obstacle to the production of perfect fabrics is the variable nature of the force by which the shuttle is projected. A certain speed of the mechanism being just sufficient to make the throw, an increase in velocity may result in causing the shuttle to rebound, thus slackening the weft, or even leaving a bight in it. Again, if the speed be reduced only five per cent, the shuttle may fail to complete its journey. The least evil consequent is that some of the threads are tight, while others lie loose; and when the completed fabric is woven, the former take the strain, giving way first; and the material, as is commonly the case with poor and cheap silk, "cockles," and speedily becomes valueless. The greater evil is a "smash," which must occur where the shuttle either rebounds into the sheds or fails to pass through them. It then is struck by the lay, the delicate dents of the reed are bent or broken, and the threads of the warp in the vicinity are destroyed. Hours may be required to repair the damage; but even then, the loom overseer has no assurance but that, before the machine can make half a dozen strokes, the same accident may re-occur and necessitate the same outlay in time and expense. In making fine goods the bending of the dents is practically irreparable; and to continue weaving the piece with the reed injured, however slightly, is to produce a fabric with a slackly woven streak in it.

Again, the character of the selvedge of certain goods is one of the criterions by which the quality of the article is determined. To make a perfect selvedge, however, a very delicate adjustment is required to draw the thread of the weft firmly up against the exterior threads of the warp opposite the shuttle, after the latter, having completed its flight, comes to rest just prior to the beat of the lay. This adjustment is exceedingly difficult to attain; and where it fails, the quality of the goods is again injured.

Lastly, the fly shuttle is a source of no inconsiderable danger. Guards have been devised for keeping it in place, and great ingenuity has been expended in the means for checking and reversing its motion. But it is obvious that the picker rarely strikes it so as to propel it in identically the same line, and that slight variations must constantly occur. From these and other causes, determining, perhaps, a failure of the safeguards, the shuttle has often been known to leave the loom and seriously to injure the operatives. It was only recently that we learned of a case where an unfortunate mill girl was struck in the eye and totally blinded, and there have been instances where the sharp pointed projectile has inflicted fatal wounds.

IMPROVEMENTS IN PICKING.

To remedy all these defects, there have been but few efforts. The air pump pick was an attempt to drive the shuttle by compressed air, forced into a cylinder, the two long piston rods of which gave motion to the drivers, which impelled the shuttle. This was a failure. Another and more successful device includes a long needle or arm, which carries the shuttle through the warp, then is withdrawn until the lay is beaten, and finally is returned to catch the shuttle and draw it back. This may be seen at the Centennial Exposition, applied to a carpet loom, for which class of machine it is best adapted. A double weft is thus laid in the warp. This is useful for ingrain carpets, but not available, for obvious reasons, for other fabrics. Another and somewhat similar plan includes two hook arms and no shuttle. One arm carries the bight of the weft into the warp for half the distance and delivers it to the other arm, which extends in similar manner from the opposite side. Still another ingenious inventor unsuccessfully attempted to draw the shuttle through by magnets moved above and below the sheds, but the shuttle persistently attached itself to the nearest lodestone, and refused to proceed further without destroying the warp threads in front of it. A device successful for short throws, not exceeding five inches or thereabouts, is a rack and pinion under the shuttle carrier. This is now employed in weaving ribbons and other narrow goods, and may be seen on the looms engaged in weaving bookmarks at the Centennial. One more invention is also worthy of notice here, though it failed, and is obviously of no practical value. It was positive, however, inasmuch as a cam traveled under movable needles, and these, rising through the warp in rear of the shuttle, surely but very slowly pushed the latter through.

The above will serve to convey to the reader some general idea of the difficulties existing in the loom, as well as of what others have done to remove them, at the period when Mr. James Lyall began the study which led to his remarkable invention.

Fig. 2.

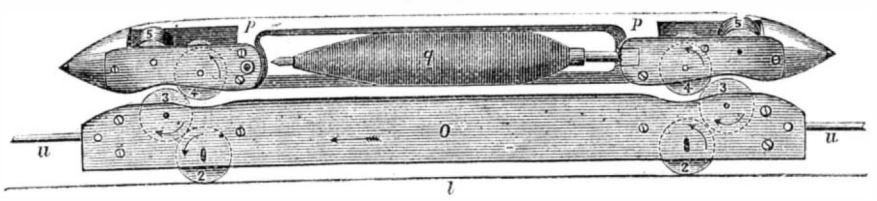


Fig. 3.

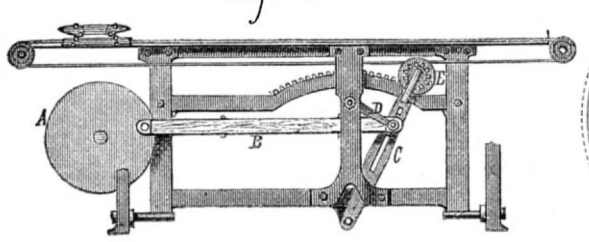
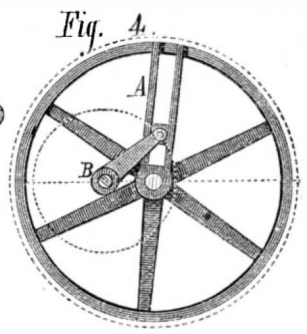


Fig. 4.



THE POSITIVE MOTION SHUTTLE.

THE POSITIVE MOTION SHUTTLE.

We now proceed to the explanation of that device, the essential features of which are represented in Fig. 2, where the shuttle is shown resting on its carriage, *o*. Motion is given to the carriage and through it to the shuttle by means of a stout band, *u*, which passes over grooved pulleys fixed to the ends of the lay and communicating with a single large pulley underneath the loom, to which, by special mechanism hereafter to be described, the proper movement is imparted. The wheels, 2, of the carriage are pivoted to the ends of short horizontal arms; the wheels, 3, are simply journaled in the carriage. The weight of the latter, therefore, rests on the pivots of wheels, 3; and as these rest on the tops of wheels, 2, it follows that they must receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of wheels, 2, which is likewise equal to the motion of the carriage along the raceway, *l*. Now suppose a sheet of parallel threads to be stretched above this carriage and beneath the shuttle, *p*. The only points where these threads will be in contact with carriage and shuttle are obviously between the wheels, 3, of the former, and wheels, 4, of the latter. If we move the carriage so that the wheels, 2, revolve to the left, wheels, 3, will rotate to the right; and supposing the shuttle removed, it is clear that, while the threads are successively raised as wheels, 3, pass under them, the rotation of said wheels precludes any lateral movement on their part. It is easy to see that the laying of the shuttle in place above the carriage will in no wise affect this result, because the wheels, 3, rotate the wheels, 4, at precisely the same speed; so that the successive threads, for the inappreciable instant of time during which they are between shuttle and carriage, sustain no disarrangement from their normal position beyond the very slight elevation, a small fraction of an inch, caused by wheels, 3. This clearly imposes no strain, while a moment's consideration of the mechanics of the device will show that friction on the threads is practically nothing, being applied at the mere line formed at the place of contact of two rolling bodies, and this never twice at the same points considered in horizontal succession from thread to thread, because the sheds are constantly alternating and constantly being moved bodily away as the weaving progresses. The wheels, 5, do not engage with the wheels, 4, but roll along the under surface of a beveled rail, holding the shuttle down to its work. The shuttle is dovetail in section, and, when in place with its carriage, can only be removed by drawing it out at the end of the lay.

THE LOOM MECHANISM.

The ingenuity and beauty of the device above described alone would be amply sufficient to secure prompt recognition of its surpassing value; but the inventor has grouped about this chief feature of his invention a wealth of novel movements and mechanical combinations, which are also well worthy of notice. Everything is positive; and when we state that cams are abolished and the crank everywhere substituted, we perhaps sum up all in the fewest words.

The two diagrams, Figs. 3 and 4, will serve to convey an idea of two of the most important devices out of several for effecting similar purposes. It is necessary in many cases to produce a dwell or period of rest, either in the shuttle or the lay. In the one case the shuttle stops sufficiently long at the end of its run to allow of the lay being beaten; in the other, the lay delays its beat sufficiently for the shuttle to make its journey. The dwell in the lay is necessary in making heavy goods. In all cases it is a great desideratum to have the motion of the shuttle swiftest midway in its course, and gentle at the ends; and one way in which this is accomplished is shown in Fig. 3, where A is a crank disk, from which motion is imparted by a connecting rod, B, to a sliding block in the slotted vibrating arm, C. D is a link attached to the sliding block and pivoted to the frame. Arm C, carries, as shown, the wheel, actuates the shuttle band, and is itself rotated by a rack and pinion device, clearly represented. When the crank disk starts from the position exhibited (the shuttle being at the end of the race), the sliding block is at the upper end of the slot in arm, C. Hence the arm, and consequently the shuttle, is given very slow motion. But as one end of the connecting rod is carried up the disk, its other end causes the sliding block to descend to the arm, the wheel on the outer extremity of which, therefore, constantly receives an accelerated motion, which is most rapid when the shuttle is midway in its course, and gradually in the same manner decreases until the pick is made. The shuttle is never returned until the lay is got home; so that on matter what the position of the shuttle is to the race when the loom is stopped, on starting again the first thing done is to draw it out of the way of the lay.

Dwell in the lay, an obvious necessity when the shuttle, in weaving wide fabrics, has to travel a very long distance, is obtained by the device shown in Fig. 4. A is a slotted pulley wheel, in the slot of which is a sliding block, to which is attached the crank of the shaft, B, which imparts motion to the lay. The crank wrist is eccentric to the pulley; and as the latter revolves, it moves radially in the slot. Consequently when nearest the center it imparts an extremely slow or no motion to the shaft, B, and a quick movement when it has traveled out toward the circumference.

THE EXHIBIT AT THE CENTENNIAL.

Without dwelling further upon the general features of the invention, we may pass to some of its practical applications as exhibited in the magnificent display made by Messrs J. & W. Lyall at the Centennial. The five great looms (taken from the factory in West 23d street, New York city) are located in a commanding position in Machinery Hall, and are represented in the superb engraving which occupies our initial page. These we shall consider briefly in their order, pointing out their several merits and capabilities. To the left of the enclosed space is seen the largest loom in the world, a physical embodiment of the fact, which the reader has doubtless, ere this, divined, that the width of fabric which can be woven by the Lyall loom is unlimited. Weaving wide fabrics, such as oilcloth foundations, by the hand loom hitherto has been a most arduous undertaking; three men were required, one at each end, to drive the shuttle with heavy hammers, a third to stand between them and aid them in beating the lay. It was labor of the severest sort, and those engaged in it became prematurely old. Contrast this with the colossal machine which scarcely requires the attention of the single young girl in front of it. Imagine a fabric woven 8 yards wide and 40 yards long in ten hours, 320 square yards of cloth in a single day. Ten such looms could make enough material to cover the enormous area of Machinery Hall in less than three weeks. The huge shuttle travels 31 feet at every throw, and its journey is completed 35 times in a minute. No need of a mechanical counter for the machine itself at the Exposition. It is only necessary to watch the involuntary motion of heads and eyes of those who stand in wonderment before the loom, as, like so many Chinese dolls, they gravely wag their craniums from side to side in time with the shuttle. The great loom is made in two yard sections, in other words, the lay is really beaten up in four places at once. This gives all the strength of fabric which would be imparted by four narrow looms placed side by side. The back beams are sections of 1 yard each, so that they can be made on an ordinary warping machine. In the loom they are united in one by male and female clutches. There is a dwell, of course, in the lay to accommodate the shuttle.

No one can witness the operation of this great apparatus, nor indeed of any of the others below described, without being impressed with the ease and grace with which the shuttle operates. There is no breaking of the yarn, no constant stopping for repairs, but perfect smoothness in every motion. We can readily believe the manufacturers' statement that the loom will weave shoddy almost too weak to stand its own weight, or filaments like cobwebs in their delicacy and fineness. Huge looms similar to that at the Centennial are now weaving all the oilcloth foundation that is made in the United States, and have stopped our

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importation of that fabric from Scotland, where it was manufactured by the laborious method already described.

The three machines, represented in our engraving on the side of the enclosure opposite to the great loom, are, first, the bag loom, in the foreground; second, a ten-quarter cot ton loom; and third, a heavy jute carpet loom—three admirable exemplifications of the wonderful capabilities of the invention.

THE BAG LOOM

weaves four seamless bags with one mechanism. There are four shuttles connected by rods in the single raceway; and they are caused to travel so that each, in passing to one side or the other, fills the place formerly occupied by its neighbor. The bottom of the bag is closed in the loom, so that, as the bags are woven, it is merely necessary to cut them apart. The weaver is, besides, enabled to examine both sides of her work, and thus the holes and defects in the under sides of the bags, which in some other looms cannot be examined, are avoided, and a perfect fabric produced. The machine travels at the rate of about 120 picks per minute, and in construction it is mechanically beautiful. That it must eventually supersede other methods of bag weaving seems to us merely a question of time.

THE CARPET LOOM,

in the distance, has a large cop in its shuttle to make heavy jute striped carpet. Its running is the perfection of ease. It makes 110 picks per minute, or about 100 yards of carpeting per day.

THE TEN QUARTER COTTON LOOM

is exhibited at the Exposition weaving unbleached sheeting for the well known New York Mills, of Utica, N. Y. The fabric produced is pronounced by competent judges to be unexcelled in point of fineness and level. One girl can attend three machines with ease. The speed is about 94 picks per minute. In this loom are embodied some most ingenious new mechanical devices, in the shape of compound let off motion, variable dwell crank, thin place protector, etc. It is a piece of mechanism well worthy of study in its every part, and its value may be estimated from the fact that the type which it represents has been adopted by the leading mills of the country, those above named and the Wamsutta Mills, of New Bedford, Mass., and many others.

We leave for the last the description of a machine which, were all we have already alluded to blotted out of existence, would still be sufficient to ensure for its inventor a world-wide fame. We refer to

THE CORSET LOOM,

represented in the center of the illustration. It is a marvelous combination of the positive motion and power loom with the Jaqcuard apparatus, an embodiment of the three greatest inventions ever made in the weaver's art. Four webs of corset are woven at once, in perfect form, all precisely similar and yet possessing every gore, every gusset, every welt formerly laboriously put in by hand work. Five corsets per day was the extent of the labor of the German weaver; this wonderful invention makes eighty-four in infinitely superior manner in the same period of time. The Jacquard cards govern the quantity of warp to be kept in action, so that, when for instance the parts which fit about the protruding portions of the body are to be made, only a certain portion of the warp is kept in play, and through this only the weft passes. As the shuttle then does not pass through the whole warp, but over a portion of it, it would necessarily seem that a slack loop of weft, corresponding to that portion in length, would be left. This is provided for by a let-off device in the shuttle, so that the thread, passing to and fro (after leaving the bobbin) several times between extended leaf springs, is always held taut, and thus only the exact amount required for the pick is allowed to escape.

This machine lies at the foundation of a great industry which has already achieved a fair footing.

THE POSITIVE ADVANTAGES OF THE POSITIVE LOOM.

Thus far we have indicated the immense value of the Lyall loom principally negatively, by showing wherein older devices have failed; it remains now to sum up, in brief terms the advantages which the invention secures, and these are: First, the abolition of the picking sticks; second, a positive motion to the shuttle from any point in its course; third, the unlimited width of the fabric which may be woven; fourth, the unlimited variety of fabrics which may be produced, from the finest silk to the heaviest carpet, from jute oil cloth foundation to exquisite woven embroideries; fifth, the almost total absence of wear, through the small motion of the reed which thus wears but little on the warps, through the small opening of the heddles which thus offer less strain on the same, through the absence of friction of the shuttle on the yarns, and the non-subjection of the weft to sudden pulls on starting; and sixth, the extremely small amount of power required to operate the looms. We saw the huge 8 yard machine, driven by a 3½ inch belt, and easily worked by hand power exerted on the gearing. We were told that it required but half a horse power for its operation. We saw, furthermore, that, as the great engine at the Exhibition slackened and stopped at noon, the looms continued weaving until their momentum gradually succumbed

We can add no better conclusion than by repeating the opinion we expressed regarding the invention shortly after its first appearance: "It is to the loom what the link motion is to locomotive engineering, or the compass to navigation. It substitutes certainty for uncertainty, and thus lays the foundations for future development in the textile arts hitherto unattainable. Radical in its character, it may be compared to the invention which placed the eye of the sewing machine needle at the point; and like that in vention, it will in its proper field be likely to produce results impossible at present to estimate at their true value." Bold predictions, many pronounced these when we uttered them; but that they are fulfilled even in greater measure than we anticipated, the whole weaving industry of the country will bear us witness. That there has been no corresponding advance in weaving since the application of power to the loom may confidently be asserted; that within late years no invention in any field has exceeded this in importance and value to humanity is likewise truth. It will pass to posterity as one of the great triumphs of American inventive genius, as the peer of the grand accomplishments of Watt and of Arkwright, of Whitney and of Jacquard.

Correspondence.

The Weight of a Body in a Hollow Sphere.

To the Editor of the Scientific American:

Your correspondent, whose communication appears on page 84, seems surprised to find that the "body in a hollow sphere doctrine" is endorsed by Professor Young He will probably, upon inquiry, find that not only Professor Young, but every professor of standing in the scientific world endorses it, and none have ever repudiated it. It was first demonstrated by Sir Isaac Newton, and mathematical demonstrations are not easily set aside.

Let A represent the hollow sphere, and B the body placed within, say half way between the center and one side. Then let *a* represent a certain portion of the mass of the shell, which of course attracts B in that direction, and let *b* be the mass which is opposite to *a*, and attracts it in the other direction. Let *c* represent the distance of *a*, and *d* the distance of *b*. Now the attraction is inversely as the square of the distance; consequently the relative forces are as $\frac{a}{c^2}$ on the left, and $\frac{b}{d^2}$ on the right. But the force is also directly as the mass; and *b*, being farther off, is a greater area, and hence a greater mass (included within the angle), than *a*, and is just as much greater as the square of the distance, *d*, is greater than the square of the distance, *c*. That is, the mass, *b*, is to the mass, *a*, as d^2 is to c^2. Hence $b = \frac{a \times d^2}{c^2}$. Now in the expression of the force on the right, $\frac{b}{d^2}$, we will substitute for *b* its value $\frac{a\,d^2}{c^2}$; and we have: $\frac{a \times d^2}{c^2} \div d^2$ or $\frac{ad^2}{c^2}$. Now, cancelling d^2, which appears both as multiplier and divisor, we have $\frac{a}{c^2}$, just the same as on the left. It ought to be obvious to any one that the body, B, is attracted equally in both directions, and hence will be at rest as far as the portion of the mass, *a*, and all the mass exactly opposite, *b*, are concerned: also that the same will apply to every point of the sphere and to every position of the body, B. Hence "a body placed within a homogeneous hollow sphere of uniform thickness will, so far as the attraction of said sphere is concerned, remain at rest in any position."

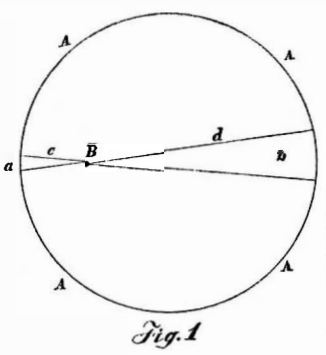

Fig. 1

Between this proposition and theother, given by Olmsted, that "a body lowered toward the center of the earth would lose in weight in proportion to its distance downward," there is no discrepancy whatever. Of course it is understood that he means this upon the supposition that the earth is homogeneous, leaving out of consideration the difference of density at different depths.

Let us take the case presented by your correspondent. A body upon the surface of the earth, at A, weighs, say, 24 lbs. If lowered to P, half way to the center, C, it passes ⅞ of the "mass," that is, it reaches a new circumference, P E F G, inside of which there remains but ⅛ of the whole mass. Thus the whole ⅞ outside of this line, farther from the center than the body at P, being neutral according to this theorem, P is still attracted toward C by the mass within, which is ⅛ of the whole.

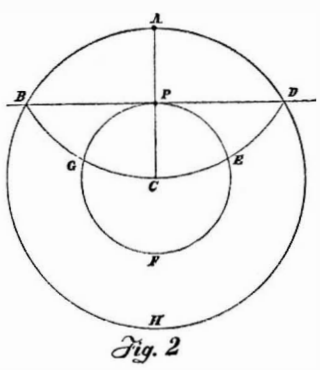

Fig. 2

But it does not follow, according to the "queer theorem," that it would weigh but ⅛ as much as at A. Your correspondent has quite overlooked two considerations: 1. Masses attract each other with a force in inverse proportion to the square of the distance. 2. The distance from P to C being but one half from A to C, the attraction of the interior ⅛ for the body at P is four times as great as that of the same ⅛ when the body was at A twice as far from C.

Hence, the mass being ⅛ as much, and the square of the distance four times less: $4 \times \frac{1}{8} = \frac{1}{2}$, and this is the amount of attraction at P.

One half of 24 is 12; so that, according to this "absurd theorem," the body weighing 24 lbs. at A will weigh 12 lbs. at P, half way down, just as your correspondent believes it would, in fact; and the old proposition does not "fall to the ground," but agrees exactly with the other.

Davenport, Iowa. W. H. PRATT.

Weight On and In the Earth.

To the Editor of the Scientific American.

With your permission I will show Mr. Whitman the error into which he falls in attempting to disprove the mathematically demonstrated "body in a hollow sphere doctrine." A careful study of his own diagram will prove that the external shell cannot exert any influence on the inclosed body. I will demonstrate it in the following simple manner: Let E, Fig. 1, be the shell of uniform density, C the center, B the body, and A D a diameter passing through C and B. Suppose the distance, A B = three times B D; it is plain that the body cannot depart from the line, A D, because we have equal masses at equal distances from the body on all sides of the line. It is also plain that it cannot approach A or D, being equally attracted in both directions. This last assertion I must prove: Imagine four lines passing through the center of B, and touching D at the four corners of a surface one inch square. If these lines are produced to A, they will touch A at the four corners of a surface three inches square. Produce these four lines through both sides of the shell; and the parts of the shell within the lines will be two masses, the one at A being nine times as great as the one at D. Now supposing the mass, A, to be divided into nine masses, each as great as the mass, D, each one of these small masses at A exerts ⅑ of the attraction on B that D exerts, because placed at 3 times the distance. The nine small masses at A then exactly counteract the attraction of the mass, D.

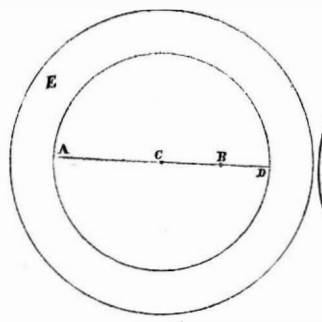

Fig. 1

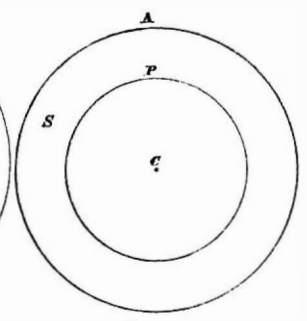

Fig. 2

I will now show why a body which weighs 24 lbs. at the surface of the earth will weigh 12 lbs. when lowered half way to the center: At A, Fig. 2, the body weighs 24 lbs.; remove the shell, S, and still keep the body at A, and it will weigh but 3 lbs., because attracted by a body ⅛ the size of the earth. Now place the body at P on the surface of the small sphere, and it will weigh four times 3 lbs., being at one half the distance from C, as when at A. Attraction does not vary in inverse proportion to the distance from the attracting body, but in inverse proportion to the square of the distance. JAMES M. PALIN.

Savannah, Ga.

Locomotives for Steep Grades.

Messrs. Copeland & Bacon, of this city, have constructed, under the supervision of Mr. Henry C. Walters, and from his designs, a locomotive for use on inclined railroads, and we have had the pleasure of observing its workings on an inclined track. The engine is worked by means of a strong wire rope which runs from one end of the track to the other, making several turns around two large drums on the engine, one above the other, the upper drum being connected with the steam power by means of a huge cog wheel. Six of these locomotives are to be built by Messrs. Copeland & Bacon for use on a couple of mountain roads—one near Salt Lake and the other near San Francisco. They are four miles long and very much curved, and do a freight and passenger business, connecting two other railroads with each other. The locomotive works finely, and can be stopped anywhere on the steep plane.—*Bridgeport Standard.*

A New Odontograph.

Professor S. W. Robinson, of the Illinois Industrial University, has devised a new and very simple odontograph for describing accurately and quickly, all kinds of gear teeth, such as epicycloidal in every form, involute, etc., without the aid of any other instrument. The device is a ready made scribe templet of flat brass, graduated and finished alike on both sides. By means of tables given once for all, it is properly set for the face or flank of a tooth; and by means of countersunk holes, it may be mounted by wood screws on a radius rod and swung round to position for each tooth of the wheel. The device may be examined at the Centennial Exposition in Machinery Hall, at B 10, column 77, and its theory will be found fully explained in No. 24 (just out) of the Science Series, published by D. Van Nostrand, 23 Murray street, N. Y.

Falling Hair.

A correspondent of the *Medical and Surgical Reporter* asks: "What will prevent the falling of hair? I have used, for the past ten years, in my own case, and prescribed frequently for others, the following with complete satisfaction: Glycerin and tincture capsicum, each 2 ozs., oil of bergamot, 1 drachm; mix and perfume to suit. This is to be the only dressing for the hair. Wash the head occasionally with soft water and fine soap.

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THE LIDGERWOOD ROTARY ENGINE AT THE EXHIBITION.

We have already explained the construction of this machine and some of its other forms, in previous issues. It is sufficient here to point out some of the advantages of the type illustrated, which is designed for hoisting in mines and quarries, and represents one of eight similar engines lately completed by the manufacturers for Messrs. L. B. McCable & Bro., of Baltimore, Md., for use in the permanent water supply tunnel of that city. The machines, being reversible, are each connected with two elevator platforms, one of which ascends while the other descends. They lift 6,000 lbs. with a single rope at a speed of 200 feet per minute, and at about 60 lbs. steam pressure. Larger sizes of the engine are capable of hoisting up to 7 tuns, at 250 feet per minute. There are no centers, and by manipulating the single lever the steam is made to hoist, lower, or hold the load.

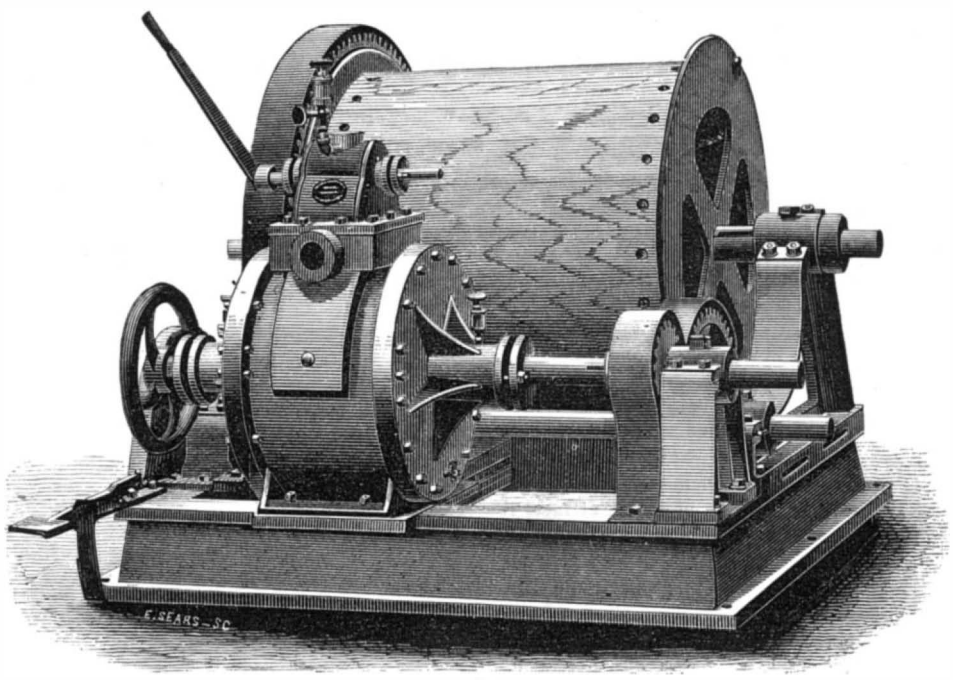
Small hoisting engines of the Lidgerwood type are now in use on board steamers for raising coal, ashes, etc., and have found a wide utilization in quarries and along docks where cargoes are constantly handled. The portable engine and boiler, which is the third form in which the machine is constructed, is a very completely arranged apparatus, containing everything in the shape of necessary fittings, including a compact heater for the feed water. It is made self-propelling if desired. Still another form is the adaptation of the rotary engine to platform elevators, such as are used in hotels, warehouses, stores, etc. This has compound gearing, which runs noiselessly, and a brake on the flywheel for controlling the load, manipulated by the same lever that governs the engine. There is also a governor for regulating the rate of speed in hoisting or lowering, and the construction throughout renders the machine well adapted for the especial purpose for which it is built.

All of the above forms may be seen at the Centennial Exposition. The small hoisting engines will be found at work raising ashes in each of the three boiler houses. Several other Lidgerwood engines are at work at the Centennial.

Another adaptation of the rotary engine, and one which has deservedly attracted considerable attention of late, is to the propulsion of small steam yachts or launches. We are informed that in this particular the Lidgerwood machine has attained considerable success. Nine boats, varying in length from 28 to 50 feet, have been fitted with the engine; and one, now in process of building, which is to be 42 feet long, with 6 feet beam, and 3 feet 6 inches depth of hold, is to be propelled at the speed of 12 miles per hour by a Lidgerwood engine equal to a 5x6 inch reciprocating machine.

Among the other advantages of the device, not yet noted, are its simplicity, it having but eight pieces exclusive of bolts, its smoothness and rapidity of action, the fact that its working parts are covered, the absence of brakes, except of course in the elevator engine, and its general utility for all purposes of hoisting or elevating.

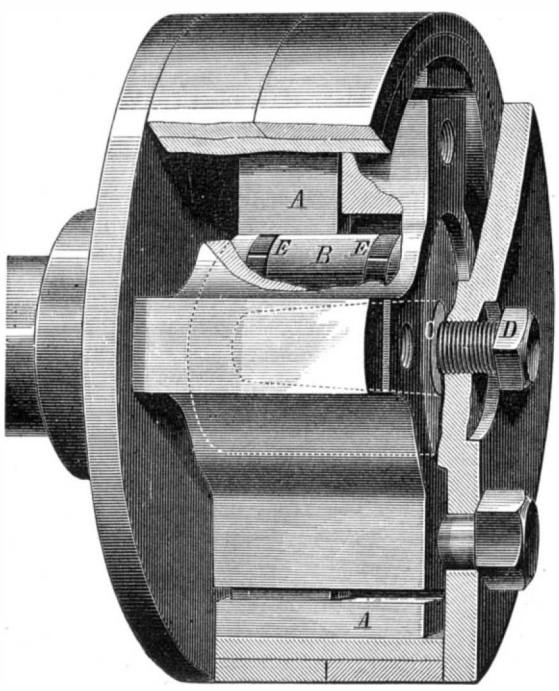
Further particulars may be obtained by addressing the Lidgerwood Manufacturing Company (P. O. box 2,132), 165 Pearl street, New York city.



THE LIDGERWOOD ROTARY ENGINE.

WOOD'S IMPROVED PISTON.

We illustrate herewith a universal expanding device for the pistons of steam engines, which is capable of expanding the packing rings equally with a positive motion; so that, while the piston can be adjusted as desired, it acts, while working, like a solid piston. While, therefore, it can be regulated so as to take up the usual wear, it will not accommodate itself to the inequalities of the cylinder, nor wear more in one place than in another. A further advantage offered, as will be seen from the following description, is that the necessity of removing the follower in order to adjust the packing, is obviated.



At A are the followers, which slide in suitable ways in the piston head. B is a central core or cylinder, which is bored out conically, as indicated by the dotted lines, and which is provided with a conical plug, C, which is forced in by the screw, D. The core is made in segments held together by circular springs, E, placed in grooves on its exterior. The followers abut upon this core, and also have feet which press against the packing rings, so that, when the plug, C, is forced in by the screwdriver, the core is expanded, and the followers, driven outward, produce a uniform expansion of the rings. The piston rod, instead of passing through the head, is screwed into a boss cast on one side, of the head, and the plug, C, may be easily removed when desired.

Patent pending through the Scientific American Patent Agency. For further particulars address John Wood, Jr., Conshohocken, Pa.

BEDELL'S SEWER GAS TRAP.

We illustrate herewith a recent invention in a very important department of sanitary engineering, that which relates to house drainage. It consists of a terra cotta tank, A, 18 inches deep by some 16 inches in diameter by ¾ inch thick, inside of which is a U-shaped pipe, B, 6 inches in diameter, also made of terra cotta, the pipe and the tank being cast or molded in one piece. A little below the bottom of the outlet or discharge pipe, this siphon is closed by a copper valve, C, which, when down, is entirely under the water which fills the whole interior of the tank to a hight of some two inches above the valve. The tank again is sealed perfectly watertight, the cover being molded on the tank before it is baked, and the opening (shown in Fig. 2) closed by a thick plate of glass imbedded in putty and held down by thumbscrews. Around two sides of the valve, as shown in Fig. 1, are sheets of copper or tin, so that, when the valve is up, all connection with the tank is cut off, and the sewage thus prevented from entering the tank and forced to go out by the discharge pipe.

Fig. 1

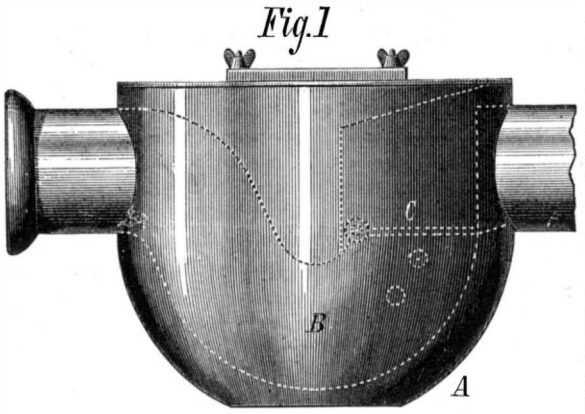
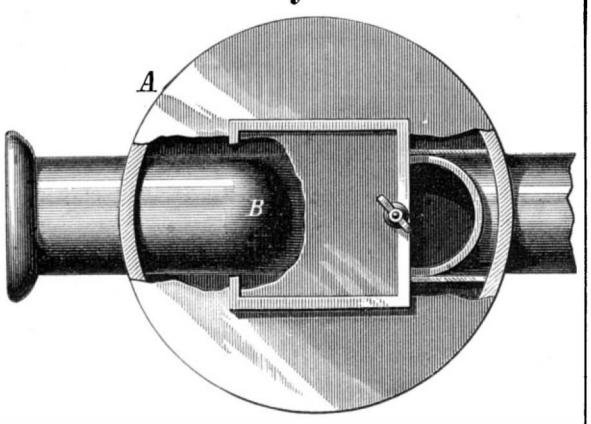


Fig. 2



The action of the trap, then, is this: The matter to be discharged enters through the pipe, which is provided with a flange or lip, flows down the siphon, and lifts the copper valve, which, as it rises, cuts off, with the two copper sides placed at right angles to it, all connection with the tank, and forces the sewage to pass out through the discharge pipe. When the matter has passed out, the valve falls, closes the opening in the pipe, and thus the process known as siphoning, by which the water is so often drawn off from similar traps, and the gas from the sewer thus allowed to pass up through the house, is prevented. The gas which comes up the discharge pipe from the sewers can, by this arrangement, get no further than the tank, for the siphon is closed by the metallic valve lying two inches under water, and the tank is filled with water to a few inches of the cover, and hermetically sealed, and the small amount of gas that does find access to the tank cannot escape either by the pipe or the tank cover.

It is well known that a sewer gas trap, to be of any service whatsoever, must accomplish two things: it must render impossible the process known as siphoning, and must offer a mechanical resistance to the pressure of sewer gas, to prevent the gas being forced through the water. These two important features are claimed to be accomplished by the invention described. We are informed that the time required to set one in perfect working order is ten minutes.

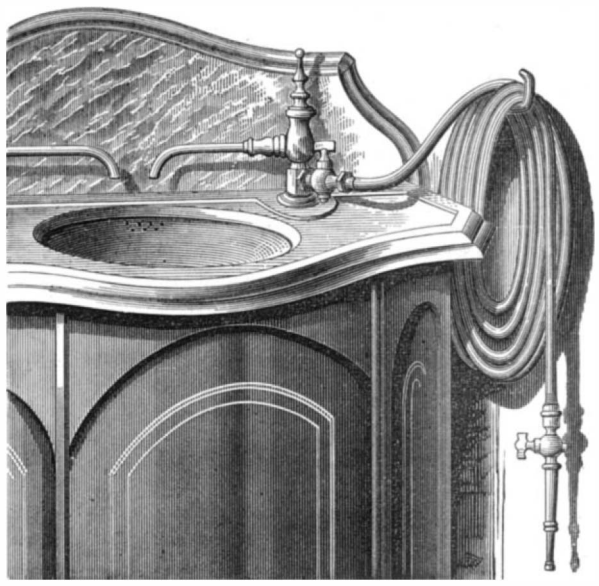
For further particulars address the patentee, Mr. William Bedell, 985 Eighth avenue, New York city.

Sensible Assertion.

The Colorado *Farmer*, published at Denver, utters the following truthful sentiment: Now is the time when the intelligent and educated farmer is going to have the advantage over the one who does not keep himself posted. When times are good, any one who knows how to raise good crops makes money. But when the country seems to have too much of everything in it, the man who picks up the improvements first, and who has raised good big crops cheap, is the man for the times; and we have to say that no man of brains, who has taken up farming for a business, should quit it now; for he cannot sell out without loss, and the time is sure to come when he will do well.

HOSE ATTACHMENT FOR FAUCETS.

It has been well said that few great conflagrations have ever occurred which a pail of water would not have extinguished, had it been on hand at the proper time. There are so many causes of little fires which may easily grow into great ones, in every dwelling, that it is a good plan to have the needful pail of water, or its equivalent, always ready; but as filled pails are not handy articles to leave promiscuously about a house, especially where there are children, the ingenuity of inventors has been taxed to supply some other means for a prompt water supply. Such a device is that herewith illustrated, it being nothing more than a length of hose provided with a nozzle, as shown, and coupled to an enlarged portion of the ordinary basin faucet. The hose is long enough to lead to any part of the adjacent room or rooms; so that in case a coal falls out of the grate and sets the floor on fire, or a curtain blows out the gas flame, or a lamp upsets, or any similar accident occurs, it is not the work of a minute to lead out the hose, turn on the water, and at once play on the incipient blaze.



The device can be used wherever there is a water pressure whether derived from a tank on the roof or from the town mains. It will also be found useful for shampooing purposes. It is one of those simple yet handy little inventions which may often be the means of saving valuable property.

Patented July 18, 1876. For further particulars relative to sale of rights, etc., address the inventor, Mr. D. G. Tremoley, 103 South Fourth street, Brooklyn, E. D., N. Y

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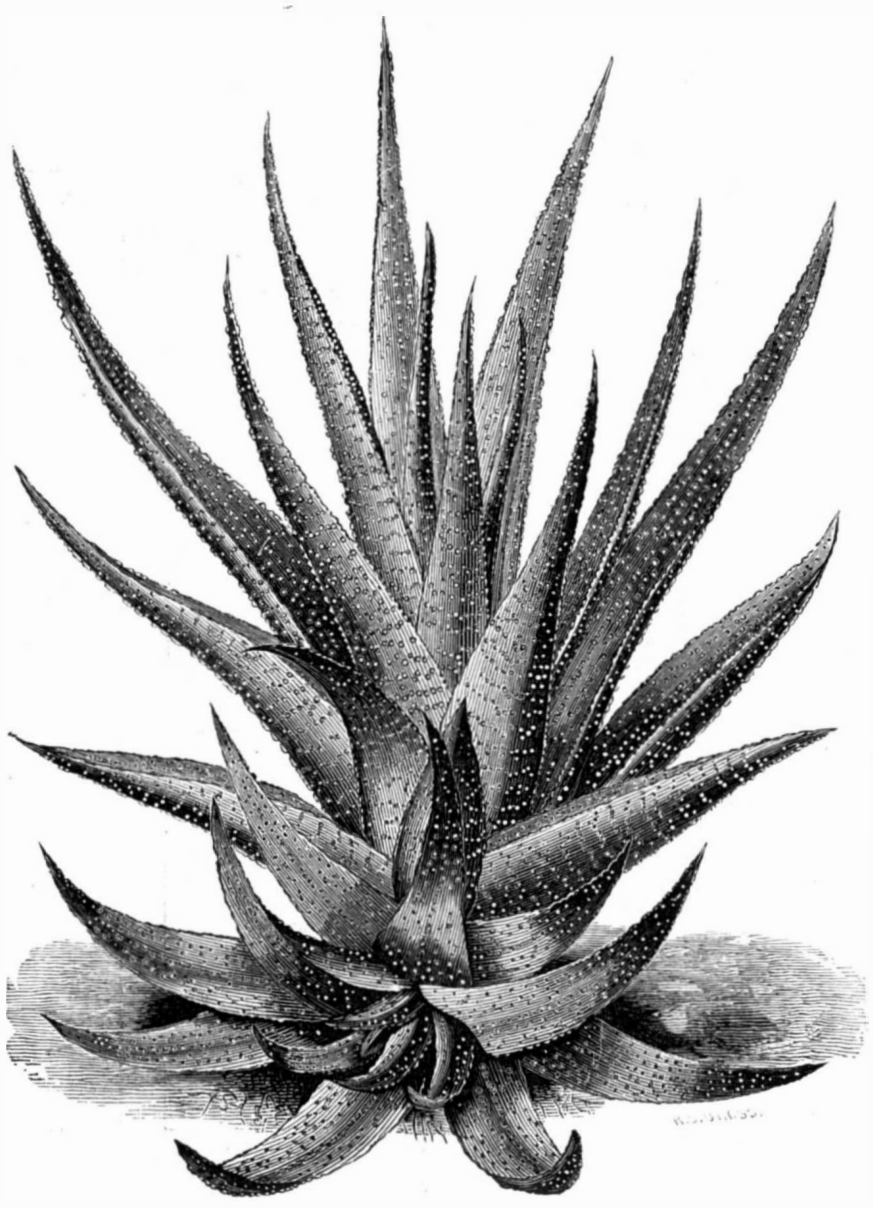
A Master Piece of Mechanism.

There has been on exhibition for some days in the store of Bates & Sons, a Little Monitor sewing machine, made from gold and silver. It is the handiwork of James W. Du Laney, a son of the inventor, and speaks highly for his mechanical ability, taste, and good judgment. The machine was shipped to Philadelphia on Tuesday last. The plate, needle bar, lifters, foot bar, tensions, spool case, and some of the screws are of gold, while the other parts of the machine are of silver and white metal. Upon the bed plate is a neat model of the Little Monitor resting upon the water and surrounded by a wreath of laurels. The Monitor has two flag staffs with flags, and the design gives the entire machine an appearance of elegance and taste that will command much attention from the sight seers at the great show. The machine is in complete working order, well wrought, and proportioned as only a master hand at mechanics could do it.

The firm has now on exhibition at Philadelphia over a dozen machines of different patterns, some inlaid with ivory, others gold mounted, and all bearing testimony to the ability of their manufacturers. In a future issue we shall speak more fully of the machine, its inventor, and the manufactory.—*Rhinebeck Gazette of July* 20.

THE PEARLY ALOE.

One of the most ornamental of the large tribe of aloes, numbering some 200 distinct species, is the *Haworthia subulata*, generally called *aloe margaritifera*, or pearly aloe, of which the annexed engraving is a representation. It has a very short stem, and leaves which are flat above and convex below; in short, triangular in shape and rounded towards the tip. The leaves are covered with a number of white, horny tubercles, which resemble pearls, and give the name to the species. The flowers are greenish, with whitish lobes marked with a green line, and are grouped together in a terminal spike. The beauty of this aloe, however, resides in the leaves, the flowers being, comparatively speaking, insignificant. It is by no means difficult to grow, nor any of the genus to which it belongs; the best soil for it, says J. C., in the English *Garden*, is a mixture of three parts loam and equal parts of leaf mold and sand, and it likes good drainage and partial shade in a cool greenhouse.



THE PEARLY ALOE.

Singular Property of Tomato Leaves.

"I planted a peach orchard," writes M. Siroy, of the Society of Horticulture, Valparaiso, "and the trees grew well and strongly. They had but just commenced to bud when they were invaded by the curculio (*pulgon*), which insects were followed, as frequently happens, by ants. Having cut some tomatoes, the idea occurred to me that, by placing some of the leaves around the trunks and branches of the peach trees, I might preserve them from the rays of the sun, which were very powerful.

"My surprise was great, upon the following day, to find the trees entirely free from their enemies, not one remaining, except here and there where a curled leaf prevented the tomato from exercising its influence. These leaves I carefully unrolled, placing upon them fresh ones from the tomato vine, with the result of banishing the last insect and enabling the trees to grow with luxuriance. Wishing to carry still further my experiment, I steeped in water some fresh leaves of the tomato, and sprinkled with this infusion other plants, roses, and oranges. In two days these were also free from the innumerable insects which covered them, and I felt sure that, had I used the same means with my melon patch, I should have met with the same result. I therefore deem it a duty I owe to the Society of Horticulture to make known this singular and useful property of the tomato leaves, which I discovered by the merest accident."

The Battle of the Gages.

A comparison of the weight and cost of a passenger train on the Eastern, standard gage, and on the Boston, Revere Beach, and Lynn Railroad, narrow gage, respectively, has been made. These two roads run nearly side by side and the carrying capacity of the two trains is practically the same. The heavy Pullman car is a disadvantage to the Eastern road in the comparison, as are also the baggage car, which is not required on the short line. A locomotive, baggage car, Pullman car, and four passenger cars on the Eastern road give capacity for 230 passengers, weigh 138 tuns, and cost $63,000; one locomotive and six passenger cars on the Revere Beach and Lynn road give capacity for 272 passengers, weigh 58 tuns, and cost $18,000.—*Engineering News.*

Railway Economy.

The long engine runs adopted last winter on the New York Central and Hudson River Railroad (engines go through between Buffalo and Albany, 300 miles) have resulted in a notable economy in locomotives, the company having been able to lay up 42 of its stock of engines, notwithstanding a large increase in traffic. There are other considerable economies effected by it, as in fuel (saving heating up, cleaning, switching, etc.); and the company is altogether satisfied of the wisdom of the change. It is not pleasant for the men, who are compelled to be away from their homes a much longer part of the time; but the economy is such that there is no prospect that the practice will be abandoned for the old one.—*Railroad Gazette.*

Construction and Maintenance of Public Highways.

The Association of Sanitary Surveyors, of London, the other day, at their late conference, discussed the question of road making, but the several bearings of the question were left unsolved. Mr. E. B. Ellice Clark, C.E., the Borough Surveyor of Derby, read an exhaustive paper on the subject, in which he advocated, for macadamised roads, a rough paved foundation, with center channels, instead of side water tables. He also suggested a paving of all streets now macadamised; and stated that granite, wood, and asphalt were severally adapted for varying kinds of roadways—namely, granite for roads where heavy traffic has to be considered, and where noise is not a material objection; wood where quietness is an essential condition; and asphalt in cases where these necessaries have to be combined, and where flat gradients and facility of cleansing can be secured.

We may learn of the old Romans the art of forming a good foundation. Large stones were first laid—in fact, a pavement was formed over the surface by by hand, the largest faces being placed downwards, the deepest stones occupying the central part of the road, to bear the heaviest traffic. This pavement of flat stones distributed the pressure; and the principle should never, it appears to us, be lost sight of in road making. The great secret in a good foundation is to distribute the weight over a large area of ground. Speaking on this subject, Mr. Ellice Clark says: "I think it might be laid down as a rule that the harder the bottom of a road is the better, whether for wood, asphalt, granite, or broken stone; and if you do not start with this initial, you will never have a sound roadway." We agree with Mr. Clark in thinking a solid hard substratum a requisite, instead of, as generally, dry core or cinder, devoid of the essential qualities of compactness and stiffness. This may be concrete—in fact, a concrete bottom seems to be the *beau ideal* foundation, though we are not necessarily compelled to resort to a metalling of the most adamantine rigidity. The truth is there is an essential difference between the hardness necessary for roads and the metallic inelasticity some road constructors advocate. Leaving the subject of foundation, we next come to the formation and the materials of the road itself. Here greater diversity of opinion exists. The battle of paving materials has been long waged, and stone, granite, asphalt, and wood have by turns enlisted the public favor. There are a great many strenuous supporters of paving, and we are told that the Manchester streets are examples of the endurance of granite sets. Of course the kind of traffic, whether heavy or light must be considered in coming to a conclusion. It is shown that Moorgate street, with a daily traffic of 7,400 vehicles, costs 33 cents per square yard per year to pave and maintain. Mr. Clarke estimates a saving of $250 a year for cleansing a street of about 3,000 square yards in area if paved instead of macadamized. Allowing $65 per yard, including concrete, as the original cost, the total cost per annum for maintenance is a little over 20 cents per yard, if we allow 8 cents per yard annually for this item. In the annual saving of cleansing, a paved road has by far the greater advantage, and we may therefore at once admit the merits of paving over macadam. The same authority says, *cæteris paribus*, "it is cheaper to pave a roadway having a traffic of 1,000 vehicles per diem over its surface than to macadamize it, and this would be the minimum number to commence paving with."

SUCCESS OF WOOD PAVEMENTS IN LONDON.

As regards paving materials, Mr. William Heywood, the City of London engineer, whose experience may entitle him to be considered an authority, says, speaking of the relative merits of asphalt and wood, asphalt is "the smoothest, driest, and cleanest paving, but wood the most quiet." As regards cleansing, wood is more difficult and expensive to cleanse than asphalt; and as both require occasional strewing with sand or gravel, there is not much difference in this respect. As regards repair both asphalt and wood can be laid and repaired with equal facility; but wood is superior to asphalt as regards safety, whether considered in reference to the distance a horse can travel before it meets with an accident, the nature of the accident, the facility with which a horse can recover its footing, the speed at which travel is safe, or the gradient at which it can be laid. As to durability and cost, it is shown that in the city wood pavements have a life varying from 6 to 19 years, 10 being an average life with repairs, that the durability of asphalts is not known, but that wood is dearest if we contrast the tenders received for laying and maintaining for a term of years. Again, referring to the safety of the materials, Mr. Heywood reports that a horse can travel 132 miles before a fall takes place on granite, 191 miles on asphalt, and 446 miles on wood. These approximate figures are deduced from observations in the London streets. From the above conclusions there is an overwhelming balance in favor of wood, though granite has its admirers, Mr. Clark thinks that, where there are few shops, and noise is not objectionable, granite is the cheapest and best material; but that in streets of business where absence of noise is a desideratum, preserved wood paving is the best, though expensive. Asphalt, with iron studs on the surface, as used by the Val de Travers Company, is, as Mr. Clark says, objectionable: though we should like to see a combination of wood and asphalt. The Derby surveyor consequently recommends for some of the streets of that town granite pitchers 5 inches by 3 inches, and for others creosoted wood. The experience of London has certainly gone to show us that wood paving is not only less dangerous and less injurious to health than granite, but also more durable than some of the asphalts. The noise of granite paving is unbearable. The objections raised against wood are the absorption of putrescent matter in the fibers, the permeability and splitting of the blocks, and the consequent undermining of the foundation. These are hardly supported by experience. Mr Deacon, the Liverpool engineer, observes that the wear is very small. Among the different kinds of wood pavement, the "Ligno-Mineral Wood Pavement," laid in Gracechurch street—Mowlem & Co.'s method—the "Asphaltic Wood Pavement," and the "Improved Wood Pavement," may be considered among the most desirable. In most of these the blocks, about 9 inches long by 3 inches wide, and 6 inches deep, are filled between with a quantity of lime and gravel, or liquid tar, or asphalt, and the grain of the wood is disposed crosswise to the surface of wear. In all cases it is desirable to saturate the blocks with oils, as in the ligno-mineral process, or to creosote them. Mr. Clark refers to some pavement at Sunderland, where creosoted Baltic red wood was tried, and which required no repairs for five years. Perhaps we may cite the "Improved Wood Pavement," now being laid in various parts of London. Two layers of inch boards, creosoted, laid transversely and longitudinally, are placed on the foundation. Upon this the blocks are placed, kept apart by strips nailed to the flooring.

NICHOLSON SYSTEM.

These joints are then filled in or rammed in with fine ballast, run with liquid tar, the surface of the road being strewn with fine gravel. An elastic foundation is given by this plan of boarded flooring, tending to distribute the pressure, and reducing the wear of the blocks. The ligno-mineral and Carey's wood pavement are laid on a concrete foundation and on a bed of ballast or sand. In the first case the blocks are sawn at an angle of about 60°, the object being to expose the fiber obliquely to the wear. The angles of each course are reversed. Henson's pavement has been tried in America with some success. The great merit of all these pavements is their elasticity.—*The Building News.*

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NEW AND CURIOUS ELECTRICAL EXPERIMENTS.

A new treatise on statical electricity has recently been published in France by M. Mascart, in which the author has collected a large number of the most curious, striking, and novel electrical experiments. Many of these have but recently been devised, and hence among the engravings, given herewith and taken from the above named work, our readers will doubtless find much that is new and interesting. The name of

ROUSSEAU'S DIAGOMETER

has been given to the apparatus represented in Fig. 1. The difference in the conductibility of two different liquids, or, in other terms, the time necessary for electric propagation across two identical masses of two such liquids, may serve

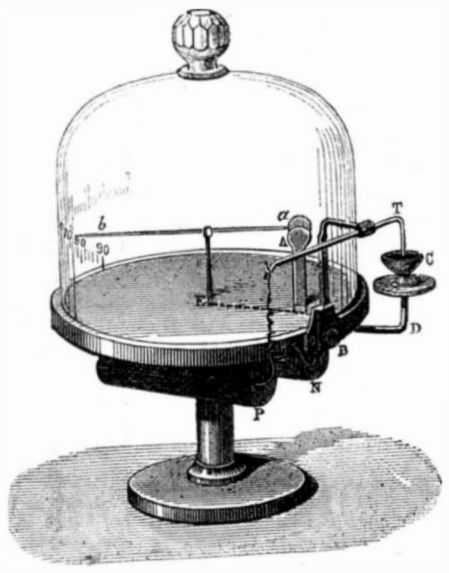

Fig. 1.—Rousseau's diagometer.

as a distinguishing characteristic. Supposing, for example, it were required to determine the degree of purity of olive oil, which, for commercial purposes, is frequently adulterated with peanut and other cheap oils The electric conductibility of the suspected material would be compared with that of oil known to be pure. The least portion of foreign oil alters this conductibility in marked degree, so that here is a novel application of physics to the detection of adulterations, a work ordinarily within the domain of analytical chemistry.

The liquid to be tested is placed in a metallic capsule, C, which rests on a disk connected with the needle, *a b*, mova ble on a central pivot. One of the extremities, *b*, of the needle traverses a dial; the other carries a small disk which, when in neutral state, rests very near the rod, A, connected to the wire, E D. A battery, P N, transmits, by the pole, P, through the isolated rod, T, and the capsule, an electric discharge into the two balls, A *a*. The time is then noted, necessary to obtain a maximum deviation under, for example, the following conditions: 1. The capsule being filled with pure olive oil, a deviation of 40′ is observed. 2. Filled with peanut oil, 25′′ is noted. 3. Filled with a mixture of the two oils, the deviation is 20′. Now a simple calculation, based on the fact, previously determined, that the conductibility of the mixture is the mean of that of its constituents, shows the measure of the fraud to be in the sample $\frac{1}{10}$. The battery used is a dry pile, that is to say, a voltaic pile formed by bodies containing little humidity, and between which the chemical action is quite weak, in order that the apparatus may retain an invariable electrical status for as long as possible. M. Roussean suggests a battery formed of double disks of zinc and Dutch metal, between which is a mixture of peanut oil and turpentine in equal parts.

GAUGAIN'S ELECTRIC VALVE.

In Fig. 2 is represented a singular phenomenon yet ur- explained. If within an egg-shaped glass globe, of form as shown, the air be rarefied by an air pump, and if between the two balls placed within a spark be caused by means of an induction coil, the following will be observed: When the positive pole is attached to the lower ball, and the negative pole to the upper one, or inversely, a galvanometer interposed in the circuit shows a constantly increasing deviation in proportion as the air in the globe is rarefied. This fact is explained by admitting that, of the two inverse currents simultaneously produced by the coil, one has always a greater tension than the other, and natu rally it is the stronger which constantly produces an effect. Thus far there is nothing re markable; but if now the lower ball be varnished, so that of its surface only a small conducting space be left, it will be observed that, for a determinate pressure of the surrounding air, the current transmitted between the two balls has always the same direction, wherever may be the points of attachment of the poles of the coil. The varnished ball seems to fulfil a part similar to that of a valve in a water or air pipe, when

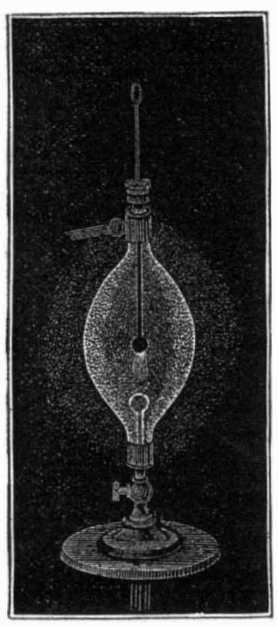

Fig. 2.—Electric valve.

so arranged as to allow the flow to pass but in a single direction.

VARIOUS FIGURES OF THE ELECTRIC DISCHARGE.

Faraday distinguished four forms of the figures or conditions assumed by the electric discharge: 1. The spark. 2. The feather. 3. The lambent illumination. 4. The obscure discharge. The spark is the fiery offshoot which leaps between two unequally charged conductors. It becomes thinner as the explosive distance augments, while keeping its brilliancy at the extremities. Fig. 3 represents the spark obtained between the conductor of an electric machine and the edge of a metal plate in communication with the soil. Beyond a certain distance from the point of emission, the spark no longer traverses a right line, but is formed of a succession of zigzags. Fig. 4 represents such a discharge at the distance of from 5·8 to 9·7 inches. If the distance is increased, the form becomes complicated, and lateral ramifying offshoots from the angles of the zigzag are thrown out, as shown in Fig. 5.

Fig. 3.—Spark to the edge of a metal plate.

When an electric machine acts in a dark chamber, luminous feathers or *aigrettes* escape from the salient parts of the conductors with a dull sound analogous to that of a puff of steam or air. These *aigrettes* are generally formed of a quite brilliant stem which suddenly splits into a large number, of less vivid violet hue. The branches in turn ramify and finally melt into darkness. Beautiful *aigrettes* may be produced by holding a metallic plate at a distance from the conductor a little exceeding that required

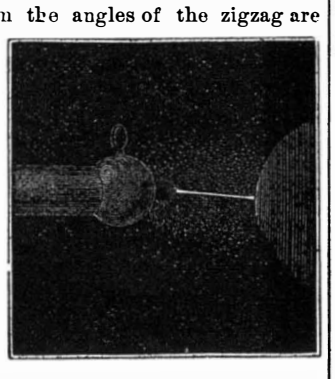

Fig. 4.—A seven inch spark.

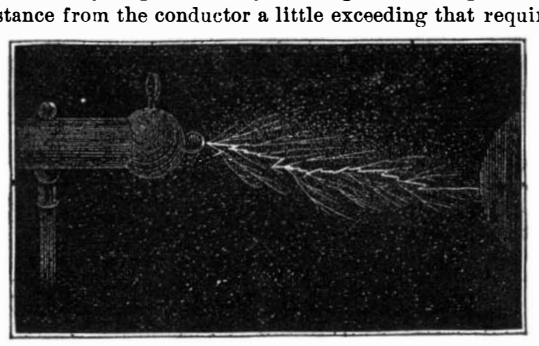

Fig. 5.—The zigzag form of electric spark.

to make the zigzag spark, and by terminating the conductor with a small ball. Fig. 6 represents an *aigrette* obtained at

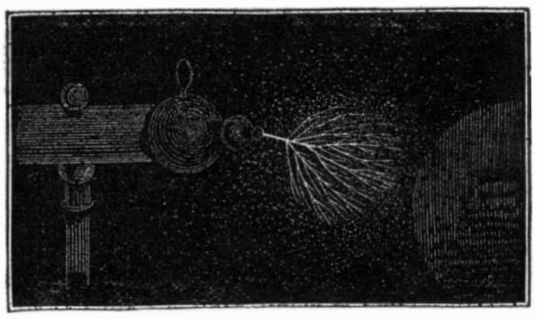

Fig. 6.—Luminous jet at a distance of 13·6 inches.

a distance of 13·6 inches. Under these conditions the edge of the disk becomes slightly luminous, although it is separated from the *aigrette* by a comparatively dark interval. *Aigrettes* may be still more clearly shown when the non

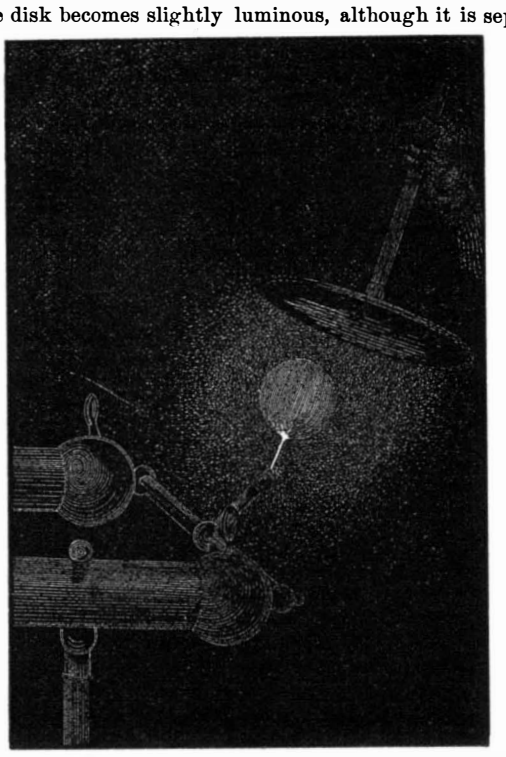

Fig. 7.—Luminous jet toward a large surface.

isolated exterior conductor presents a large surface, as shown in Fig. 7.

It happens sometimes that an electric machine in activity presents, at the extremities of its conductors, especially when they terminate in small balls, a lambent illumination of variable brilliancy and extent, tranquil, continuous, and noiseless. Faraday has shown that in order to transform an *aigrette* into this species of discharge in ordinary air, it is necessary to diminish the dimensions of the conductor at the point of emission, to force the action of the

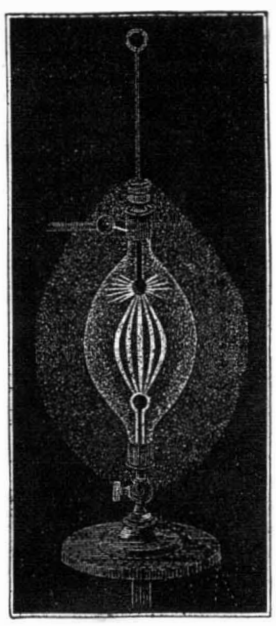

Fig. 8.—Electric egg in rarefied gas.

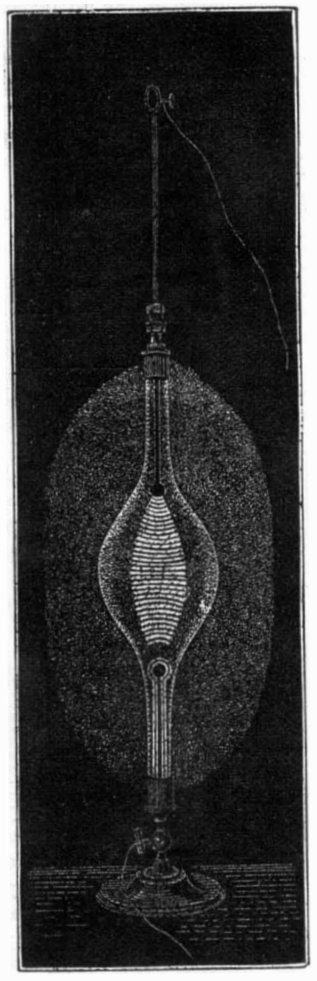

Fig. 9.—Electric egg in vapor of turpentine.

machine, and to remove all foreign bodies. The lambent discharges then appear to be the location of a continuous communication from the electricity to the surrounding air. In rarefied gases, the phenomenon is most striking. Under a vacuum of 2 to 3 inches in the apparatus known as the electric egg Fig. 8, there escapes from the upper ball, supposed to be positive, a multitude of purple bands, of which some are directed toward the sides of the globe, while others form a bundle of ribbons ending at the negative ball. At the same time the last mentioned ball and the rod which supports it are enveloped in a thick atmosphere of violet light.

If the upper portion of the egg is connected with the conductor of a machine or terminated by a point which gives a continuous flow, the discharge is not propagated over any great distance. At the positive ball appears a faint purple light, and the negative ball is surrounded by a violet halo; but the illuminations are separated by a completely obscure interval. In this interval, however, a movement of the electric fluids occurs, and hence the phenomenon has been termed an obscure discharge.

STRATIFICATION OF THE ELECTRIC LIGHT.

When vapors of alcohol, turpentine, etc., are introduced into the electric egg, previous to rarefying the air therein, and when through these the discharge is passed, the luminous emission becomes divided into strata separated by ob scure bands, as shown in Fig. 9. This is produced in all tubes containing rarefied gas. The distance and brilliancy of the strata depends on the nature and pressure of the gas, the dimensions of the tubes, and the energy of the discharges. They are more marked with a bright light and narrow tubes. The explanation of the phenomenon is not yet definitely known.

COMPOSITION OF THE ELECTRIC LIGHT.

We terminate the present series of illustrations with Fig. 10, representing the spectrum of an electric spark passing

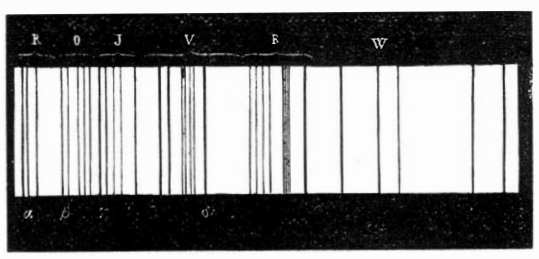

Fig. 10.—Electric spectrum between two antimony electrodes.

between two electrodes of antimony. It is the characteristic spectrum of that metal, showing the rays α, β, γ, δ, in the situations indicated between the red and the green. After a number of experiments upon spectra electric sparks, similar to others, M. Masson has reached the conclusion that the constitution of electric spectra is, for a like substance employed as poles, independent of the electric source and of the medium to which the spark passes.

TO CLEAN PLATE.—Take an ounce each of cream of tartar, muriate of soda, and alum, and boil in a gallon or more of water. After the plate is taken out and rubbed dry, it puts on a beautiful and silvery whiteness. Powdered magnesia may be used dry for articles slightly tarnished, but if very dirty it must be used wet and then dry.

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PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We give, below, brief abstracts of the papers read at the meeting of the above named society, recently held at Buffalo, N. Y.

Professor Burt G. Wilder, in a paper entitled

NOTES ON NORTH AMERICAN GANOIDS,

called attention to two pairs of serrated cartilaginous appendages of skin on each side of the hyoid arch of the mud fish. These are too flexible to serve as offensive weapons; and as their function is not known, it was suggested that they be studied in the young fish. Dr. Newberry, in the discussion following the reading of the paper, considered that the parts were remnants of an armor fully developed in the progenitors of the species.

Professor Thomas Meehan took positive ground in an essay on the

FERTILIZATION OF FLOWERS,

against the theory that plants, as a general thing, abhor close breeding, and that all flowers with color, fragrance, and sweet odors can only be fertilized by insect agency. He stated that the flowers of the black cap and other raspberries, which have neither color nor fragrance, are remarkably attractive to insects: and yet the flowers produce raspberries just as well under gauze bags, when the insects are excluded. He summed up his conclusions in the following propositions: First. Cross fertilization by insect agency exists, but not nearly to the extent claimed for it. Second. Where it does exist, there is no evidence that it is of any material benefit to the race. Third. Difficulties in self-fertilization result from physiological disturbances that have no relation to the general welfare of plants as species.

Some interesting observations on the effects of temperature in changing the

INDEX OF REFRACTION IN SPECTROSCOPE PRISMS

were made by Professor T. C. Mendenhall. From experiments made with glass heated as high as 392° Fah., it was found that the change of the index of refraction in glass for 9° Fah. is 0·00003. This affords a new scale of comparison in cases where there are differences of temperature to be considered.

Professor C. A. Young described

A NEW ARRANGEMENT OF THE SPECTROSCOPE

for obtaining lines more conveniently separated, and thus facilitating observations of the velocity of the movements of heavenly bodies through the displacement of said lines. Having calculated the scale which this new arrangement required, he applied it to observations of the comparative speed of the sides of the sun, one of which is of course approaching us, while the other recedes, because of its revolution on its axis. These observations give an average for the motion of 123 miles per second. Calculation would give by mere theory this motion as 103; but the difference by spectroscopy is within the limits of error of observation.

Professor A. W. Wright added a note, giving the results of further investigation into the nature of the

ZODIACAL LIGHT.

Careful researches on his part had shown that the zodiacal spectrum varied but little, if at all, from the solar spectrum except in length, that difference being due to the fact that the former was a faint light. The line 577, which a previous observer had found in the zodiacal light, Professor Wright thought was due to an aurora present at the time of observation. The conclusion was that the zodiacal light must be that of the sun, probably reflected from numerous small meteoric bodies, revolving around that luminary.

THE FLYING LIZARDS OF AMERICA

was a brief essay by Professor O. C. Marsh, giving a description of the principal characteristics of American pterodactyls. The animal is only known through the labors of geologists.

It was found from the American specimens that there has been a misunderstanding about the pelvis of the animal. The ischia are found firmly coössified on the medial line, and the pelvis differs in other particulars from what had been supposed. The American specimens give a clear idea, such as was not previously attained, of the hind feet of the animal. The lower end of the tibia has a pulley-like articulation, similar to the bones of a bird. There are also at least two separate tarsal bones. There is also this remarkable circumstance. In the geological horizon where the pterodactyls are found in this country, all the birds discovered have teeth, and hence are unlike all other birds: while pterodactyls are found having no teeth, and hence unlike all other pterodactyls.

Professor S. W. Garman, of the Museum of Comparative Anatomy, at Cambridge, Mass., read a paper on the

COLORS OF ANIMALS.

Despite the popular notion that the chameleon and other animals can change their color at will, he says there is a want of scientific evidence in favor of the belief. Drawing up for consideration a schedule of animals in two groups of comparative brilliance and paleness, we find that light or darkness of habitat determine the colors as a whole. The amount of light in their surroundings is in inverse relation to the brilliance of color The dark colors are found in forests and on dark soils; the light colors on plains and snow. The bleaching process applies to the lower surface, to the ventral portions of animals by reflection. In the water the same is true, the rivers with muddy bottoms being peopled by dark forms; the brilliant colors are found in hot and sunny waters or transparent lakes. This was shown in a great variety of instances.

Naval Items.

It is the intention of the navy department to put the steamers Alliance and Ranger in commission. The Alliance is of the same class as the Adams, which made such successful runs over the measured mile at League Island on August 14, the average speed for four runs being 11·3 knots, with 63·04 revolutions of the screw, developing 882 horse power. Better results would have been obtained had there been a greater depth of water on the course. On returning to her anchorage after completing the trial, she passed through 7½ fathoms of water, when the revolutions, with the same pressure of steam and same cut-off, increased to 68½, which would have given 11·6 knots.

NAVAL ENGINEER CORPS GAZETTE.

Passed Assistant Engineer L. R. Harvey detached from the United States steamer Pensacola, and to wait orders at San Francisco, Cal.

Passed Assistant Engineer J. F. Bingham detached from the Mare Island navy yard and ordered to the Pensacola.

Assistant Engineer W. H. Platt ordered to report for examination, preliminary to promotion.

Better Times at Hand.

On every side, evidences of a better state of business feeling prevails. Our merchants are confident of a good fall trade, and the fear that the coming winter will be an exceptionally severe one on our working people is being dispelled by many stable signs of brisk trade this autumn. Even in New England, where the business depression has been most disastrously felt, quite a number of large mills, silent for many months past, are starting into action and on full time, for the fall and winter. In our State, says the Philadelphia *Inquirer*, some of the furnaces, mills, and factories, shut up for over a year, have been reopened, and work has been or will be resumed very shortly. The reason of this is that prices have touched their lowest point and show signs of improvement. Stocks of goods have been reduced to the bare boards, or very near them; the products of the country have been unprecedented; and there is at last some encouragement to resume traffic with a prospect of profit, for that is the great business magnet. If our merchants and manufacturers can now resurrect the old-time commercial confidence, we may look for the dawn of better times very soon.

Tasteful Steel Plate Engraving.

We rarely seen more tasteful and novel designs for business cards, checks, letter headings, and similar work on steel than those produced by Messrs. John A. Lowell & Co., of Boston, Mass. By means of finely ruled lines, enclosed in simple yet handsome shields and like figures, effects of great beauty are produced at moderate cost. To manufacturers, bankers, merchants, and indeed all who take pride in handsome bill heads, checks, bonds, and stock and society certificates, we can recommend the artistic productions of the above firm.

NEW BOOKS AND PUBLICATIONS.

THE COMPLETE PRACTICAL MACHINIST, embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc. Illustrated by 130 Engravings. By Joshua Rose. Sent free by mail on receipt of price, $2.50. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

We have given to our readers so much practical information, on all branches of the art of producing the finest mechanical work in the most economical manner, from the pen of the author of this book, that any commendation here bestowed by us on the work would seem like egotism. The tens of thousands of skilled operatives who read these pages look regularly for some fresh instruction in manipulating tools, some new method of working out a mechanical idea, in our chapters on "Practical Mechanism;" and they are, we know well, seldom disappointed in their search. Mr. Rose justly says in his preface that the education of the machinist has not received its proper share of attention at the hands of authors who have written on mechanical subjects; and he has labored faithfully and skillfully to remedy this defect, and has produced a volume of condensed instruction, extracted from long experience in many countries, which could only be written by an engineer and mechanic of the highest skill, endowed with unusual facility in explaining and illustrating his meaning.

FILTH DISEASES AND THEIR PREVENTION. By John Simon, M. D., F. R. C. S., Chief Medical Officer of the Privy Council and of the Local Government Board of Great Britain. Price $1. Boston, Mass.: James Campbell, Publisher.

Mr. Simon's labors in the etiology of disease have been for many years regarded as the master work in sanitary science; and his reports are matters of worldwide importance, illustrating the causes and development of all the preventible diseases, which do not vary in different localities. His skill in investigation is worthily supplemented by a clear, concise, and methodical mode of explaining his views; and the thoroughness with which all his work is done gives it the highest value. The State Board of Health of Massachusetts have ordered this reprint of Mr. Simon's last essay to be published, and they state truly enough that, "if the practical suggestions made therein were acted on by all citizens, hundreds of lives now annually doomed to destruction would be saved, and the health and comfort of the people greatly increased." We shall shortly publish some extracts from this valuable document, which is one of the greatest importance to every government and people.

WOOD CONVERSION BY MACHINERY. By John Richards, M. E. London, England: J. & W. Rider, 14 Bartholomew Close.

The author of this book is a member of the firm of Richards, London, & Kelley, of Philadelphia, but has been for some time a resident of London. The essays which make up this volume have been published in the *Timber Trades Journal;* and they contain some valuable practical information on all branches of the subject. In the chapter on "patent monopoly in wood conversion," there is a boldly outspoken criticism on the action of the Patent Office in the notorious Woodbury planer case, which we commend to the attention of the woodworkers of this country. We shall probably recur to this volume again.

THE INTERCOLONIAL: an Historical Sketch of the Inception, Location, Construction, and Completion of the Line of Railway Uniting the Inland and Atlantic Provinces of the Dominion of Canada. By Sandford Fleming, C. E., Engineer in Chief of the Newfoundland, Intercolonial, and Canadian Pacific Railways. Montreal, P. Q.: Dawson Brothers, 159 St. James street.

This volume affords an excellent idea of the formidable difficulties encountered in the construction of the railway through the "wilderness," which, as the author truly says, "separated the Maritime from the Inland Provinces." The natural obstacles in the way were enormous, and they were conquered only by great courage and untiring patience; and the result is a railway which, "in all the essentials, has no superior."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 1 to August 9, 1876, inclusive.

BOILER.—A. D. Brock, Washington, D. C.
BUFFING LEATHER, ETC.—J. E. Fisk, Salem, Mass.
CHILD'S CARRIAGE, ETC.—C. F. Tenney *et al.*, Baldwinville, Mass.
COOKING UTENSIL.—J. H. Weare *et al.*, Cincinnati, Ohio.
ELEVATOR.—R. K. Terry, Jersey City, N. J.
FISH JOINT, ETC.—R. Long, Pittsburgh, Pa.
GAS GENERATOR.—W. Maynard, New York city.
HYDRAULIC PROPELLER.—G. G. Caldwell, Baltimore, Md.
INDICATOR.—J. W. Thompson, Salem, Ohio.
MICROSCOPE.—J. Zentmayer, Philadelphia, Pa.
PAPER BOX, ETC.—S. Wheeler *et al.*, Albany, N. Y.
PAVEMENT.—J. Shillinger, New York city.
PIPE COUPLING.—H. Pennie, Brooklyn, N. Y.
POSTAGE STAMP, ETC.—L. H. G. Ehrhardt, Philadelphia, Pa.
PROPELLING POWER, ETC.—F. J. Bell (of Phila., Pa.), London, England
SASH PULLEY CASE, ETC.—W. T. Doremus, New York city.
SEPARATING LIQUIDS.—J. J. Thomas, Philadelphia, Pa.
SMOKELESS FURNACE.—J. W. Bonta, New Brighton, Pa.
TELEGRAPH CABLE, ETC.—W. Strickler, Lebanon, Pa.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED LOCOMOTIVE DRAFT PIPE.

Thomas Diffenbaugh, Danville, Ill.—This is an improvement in the draft or lifting pipe of locomotive and other high pressure engines that exhaust into the chimney, which draft pipe is commonly known to locomotive engineers as a petticoat pipe; and it consists in making the draft pipe in sections, and adjustable by lever connection with the cabin of the locomotive. The common practice at present is to close up the exhaust nozzles, which, when the engine is working at full stroke, are not large enough to allow the exhaust steam to escape freely into the smoke stack, thereby cramping the engine, as the steam cannot be exhausted quick enough. By making the draft pipe variable in size, the nozzles may be made larger than at present, and the pipe then be adjusted to the volume of the exhaust steam—larger when the engine is working at full stroke and exhausting a whole cylinder of steam, and smaller when cutting off and exhausting only part of the quantity, thereby allowing the engine to work with more freedom, and maintaining a sharp draft when required.

IMPROVED PISTON.

John Wood, Jr., Conshohocken, Pa.—This invention is a universal expanding device for the pistons of steam engines, capable of expanding the packing rings equally with a positive motion, so that, while the piston can be adjusted when desirable, it acts, while working, like a solid piston; and it consists in the combination of followers sliding in suitable radial ways in the piston head, with a central sectional core or cylinder, which is bored out conically, and is provided with a conical plug, which, when forced into the sectional core, by means of a screw placed in the piston head for that purpose, expands, forcing the followers against the packing rings. The advantages claimed are that, while the piston can be adjusted to take up the usual wear, it will accommodate itself to the inequalities in the cylinder, and will not wear more in one place than in another, as is the case with packing which adjusts itself. Another important advantage is that it obviates the necessity of removing the follower to adjust the packing.

IMPROVED PUMP VALVE.

Mrs. Charlotte Thomas, executrix of William H. Thomas, deceased, Sacramento, Cal.—The object of this invention is to provide an improved substitute for frappet valves whose hinged flap, or movable piece, is composed of leather. To this end, the invention relates particularly to the valved seat composed of hard metal and having a beveled rim, the improved valve having an annulus of soft metal secured in a suitable cavity, and the vertical guides for causing the valve to seat itself accurately, these elements being conjoined under a particular arrangement whereby the valve seats itsel in the soft metal at each stroke, and always in the same place.

IMPROVED COMBINATION LOCK.

George Winter, Jacksonville, Va.—In this invention, the bolt is locked by a series of sliding dogs or tumblers provided with semicircular grooves to receive rotating pins, having semicylindrical posts adapted to fit in said grooves. When the pins are adjusted in one position, the dogs may be raised simultaneously out of the notches in the bolt, thus allowing the latter to be withdrawn into the case; but when adjusted in another position, the dogs are held locked, the semicylindrical portion of the pins in such case entering the grooves in the dogs. The position of the pins is indicated by a series of fingers inserted in the dogs, and pointing to numerals inscribed on the face of the lock.

IMPROVED HORSESHOE MACHINE.

John W. Chewning, Jr., Shadwell Depot, Va.—This invention relates to a novel construction of horseshoe machine; and it consists in the construction and arrangement of the devices for operating the swaging die and bending jaws, in the combination with the pivoted jaws of bending and guide rollers, in the construction and arrangement of the ejector for the swaged horseshoe, in the construction and arrangement of the knife for cutting off the section of the bar forming the horseshoe, and in the means for adjusting the length of said section.

IMPROVED SELF-DUMPING SCOW.

Philetus L. Murphy, New York city, assignor to himself and John A. Squires, same place.—This consists in a scow made in two parts, having the plane of division passing longitudinally through its center, the deck being inclined from the outer sides to the line of division. The parts connect with each other at one end by hinges, and at the other end by a rope, so that when said rope is released the weight of the load may force the parts apart, and thus dump the load automatically.

IMPROVED STONE-SAWING MACHINE.

James Pepler, Green Point, N. Y.—This invention consists in the arrangement of roller guides for the saws, which make it possible to make diagonal or straight cuts through a block, or to make both diagonal or straight cuts at one time in a block of stone. The operation may be described as follows: The block of marble or other stone to be sawn is placed on the support; and if it is to be worked up into monument shafts, the saws are arranged so that the rollers will guide and deflect them so that they will saw diagonally through the block. On turning the blocks over, the saws are arranged two in one socket or holder at one end, to bring them as near together as possible, to cut out the wedge between the shafts. The saws may be arranged so that part only will saw diagonally, or all may be adjusted to saw in that way.

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IMPROVED NAIL PLATE FEEDER.

William H. Rittenhouse, Norristown, Pa.—In this invention, two spring nose pieces are employed instead of the one rigid one heretofore used, in order that, when the barrel is turning over on one of them, its weight and the pressure of the bearings will spring it, and so nip the plate that it will not feed while turning. The blank from which the nail is cut obliquely across has one edge longer than the other, necessarily; and as the reciprocal feed turns the long and the short edge up alternately, in ordinary nail plate feeders, high speed is not possible, because the moving knife lifts the plate from the bed knife when, in turning, the long edge is up. But in this device, when the short edge is up, and the nose piece made to spring and bind the plate, the moving knife will clear it every time, and there is no limit to the speed, so far as the feed is concerned.

IMPROVED RAILROAD RAIL JOINT.

Duncan C. Waddell and John F. Finger, Marion, S. C.—This invention consists of a chair that embraces the bottom and inner side of the rail, and is provided with a central standard or bearing piece, which comes between the ends of the rails when they are placed in the chair, and extends beyond the outside of the rail, where it is mortised to receive a split key, that rears against the web, the said key being retained by a wedge driven in the split. The device forms a rigid support for the ends of the rails. It may either be placed on the cross ties or between them. The bearing piece between the ends of the rails permits the wheels to pass over the joint without jarring or injuring the end of the rail.

IMPROVED SEWING MACHINE FOR EMBROIDERY.

Charles Marin, Newark, N. J., assignor to himself and Isidore Rosenthal, New York city.—This invention produces embroidery stitches of varying lengths at one side of the fabric only, and retains the embroidery stitches at the ends by fastening stitches that pass through the fabric at a considerable saving of thread. The machine is made in the nature of the sewing machine, and produces, by the parallel and angular disposition of the thread, flat or raised designs of any configuration, in a rapid, even, and perfect manner. It consists, essentially, of a reciprocating needle bar, with two adjustable needles, a slotted presser foot, a swinging and parallel feeder, and a shuttle that places the embroidery stitch n position for the fastening end stitches of the adjustable needles.

IMPROVED WHEEL TIRE.

George Cornwall, Garden City, N. Y.—This consists of a tire the essential part of which is rawhide. The hide is fitted on a metal hoop while in a soft state for fixing it in the required shape, and an elastic cushion of rubber is interposed between the hide and the metal band.

IMPROVED LUBRICATOR.

Joseph W. Reed, Kalamazoo, Mich.—This invention is a double automatic lubricator for steam cylinders of locomotives and other engines, by which one of the lubricators may be dispensed with; and it consists of a cup cast in one piece with fixed internal feed pipes, having regulating top nozzles and outer cocks for shutting off the steam. The casting of feed pipes and cup in one piece makes the cup cheaper, and without joints. The steam passes up the pipes from the steam cylinder, and condenses gradually in the cup, which, by the double condensation pipes, forces the oil up the nozzles and down the pipes as long as the engine is running. When the steam is shut off, the supply of oil is interrupted, being regularly continued when the steam is let on again.

IMPROVED WIND WHEEL.

Alfred M. Vanpelt, Capioma, Kan.—By suitable construction, as the wind blows against the forward sides of the fans, it presses them against the weights, and the weights support them against the wind, unless it be strong enough to raise the said weights, and thus take the fans out of the wind. By suitable adjustment, the wheel may be arranged to work with any desired power.

IMPROVED WATER WHEEL.

Samuel G. Marlin, Clarion, Pa.—This consists of a wheel composed of two disks placed side by side, each having buckets and issues, which are so adjusted that the buckets of one fit in the issues of the other, in such manner that, by adjusting one of the disks toward or from the other, the capacity of the issues may be raised to any extent, and may also be closed altogether, if required to serve for the gate.

IMPROVED WINCH.

Elias Sorrinson, West De Pere, Wis.—This consists of a common winch, whose crank shaft is placed by sliding pinions in connection with a second hoisting drum, and with rubber rollers for taking up the slack. It serves to hoist two or more sails at once.

IMPROVED TOOL FOR CAPPING AND UNCAPPING CARTRIDGES.

Isidoro Zamboni and Carlo Zamboni, Owatonna, Minn.—This is an improved device for removing the exploded cap from a cartridge shell for breech-loading shot guns, and recapping and reloading the shells.

IMPROVED LIFTING JACK.

Thomas J. Corn, Sni Mills, Mo., assignor to himself and James M. Faulk, same place.—This consists in making the parts of a lifting jack so that they may be folded compactly together for storage or transportation. When this is desired, the lever is removed and the standards are folded.

IMPROVED MIDDLINGS SEPARATOR.

Jefferson Graham, Alden, Minn.—There is a vertically reciprocating shoe having screens, each clothed with finer and coarser numbers of bolting cloth; also a series of chutes, one set for delivering the purified middlings out of the machine, and the other for delivering the imperfectly separated matters upon the screen below. With the above, a blast fan is combined.

IMPROVED GLOVE-SEWING MACHINE.

Peter E. Gullrandsen and Johan C. Rettinger, Copenhagen, Denmark.—The object of this invention is to construct a glove-sewing machine on the revolving hook system, which produces with two threads a stepping and cross stich, that resembles and equals the best sewing done by hand, and makes the seams strong and durable. The device includes glove-feeding cups, reciprocating needle bar with tension devices, a rotating hook with bobbin and tension, and a compound mechanism for operating the cross stitching device. The horizontal actuating mechanism of the parts is inclosed below the table, and operated by a treadle, the glove-feeding cups being run close to each other, or at some distance from each other, to take hold or relinquish the work by means of a pressure spring and releasing treadle connection.

IMPROVED SLAUGHTERING APPARATUS.

Kennard Knott, London, Ontario, Canada.—This invention relates to an improved slaughtering apparatus in which the bullock is thrown down, and (after being killed) drawn out and deposited upon a car, which transports the body to the mechanism by which it is hoisted for being dressed. After the dressing operation it is lowered, divided in halves by a swinging saw, and the two parts, which are suspended from hanging tramways by wheel hooks, are quickly conveyed by said hooks into the freezing house, where they are packed, or from which they may be removed to cars or ships for transportation.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED POCKET CALENDAR.

Benjamin F. Norris, Chicago, Ill.—The improvement consists in the particular construction and arrangement of the two sheet metal disks to each other, one of which is provided with a series of indentations corresponding to the divisions of the calendar face, and the other of which is provided with a stud, one end of which affords a knob for turning the disk, and the other end of which forms a stop which enters into the indentation of the other disk, and by locking the two disks determines the proper registration of the divisions of the two disks and prevents accidental displacement of the same while in the pocket.

IMPROVED LANTERN.

Henry C. Kelly, Chicago, Ill.—This invention relates to a novel construction of the lantern; and it consists in the construction and arrangement of the burner and deflectors, the construction of the base provided with tubes for supplying air to the burner, the construction of the outlet for the hot air above, and the means for attaching the guards to the base piece, and thus connecting and holding the several parts together.

IMPROVED PUZZLE BLOCKS.

Ripley R. Calkins, St. Joseph, Mo.—The object of this invention is to provide a mechanical or material verification of the geometrical problem "that the square described upon the hypothenuse of a right-angled triangle is equal to the sum of the squares upon the other two sides." To this end the invention consists in the combination of five blocks, three of which are in the shape of similar right angle triangles, one in the shape of a trapezium, and the other in the shape of a trapezoid, which blocks are adapted to be put together to form a single square upon the hypothenuse of a right-angled triangle, or to be transferred or arranged in two squares upon the other two sides; the same to be used in schools for purposes of illustration, or to be used as a puzzle for general amusement.

IMPROVED STREET LAMP.

Lewis O. Cameron, Pittsburgh, Pa.—The improvements constituting the invention are embodied in three features, namely: 1st. Constructing the glass body of the lamp with a large opening at the bottom, and providing adjustable perforated plates for closing the same, the said plates being attached exteriorly. 2d. Making the metallic cap or top portion of the globe adjustable and removable. 3d. Providing the lamp with a detachable holder or reservoir for gasoline or other light hydrocarbon.

IMPROVED BROMINE STILL.

Freeling W. Arvine, Mason City, W. Va.—The points of novelty in this invention consist in making the still with a funnel-shaped bottom, introducing the steam pipe at the lowest point of the same, and providing an annular orifice for the escape of the liquid product. It also consists in providing a return pipe for the escaped bromine at the mouth of the receiver, and conducting the gas to an absorber where it is dissolved in bittern and returned to the still for utilization by decomposition.

IMPROVED HORSE DETACHER.

Amos M. Barker, Macon, Neb.—In using the device the cock eye of the tug is put over the outer arm of a double hook, and the head of a rod is placed in the space between the points of the said double hook, holding the hook securely in place. Should it become necessary to detach the horse, the driver pulls upon the cord attached to the arm of the rod. This turns the rod and raises its head out of the space between the points of the double hook, when the draft strain turns the hook forward, draws the tug from the said hook, and the horse is detached.

IMPROVED POCKETBOOK FASTENING.

Ernst Schnopp, East New York, N. Y.—This lock consists of a face plate, with swinging handle, applied to the closing flap of the pocketbook. It has a center knob at the under side of the same, that enters a centrally perforated radial spring plate for closing the lock, the button being released by pulling at the face handle.

IMPROVED TEMPORARY BINDER.

Ferdinand Guicheteau, Brooklyn, N. Y.—This invention consists in the combination of a spring clip of novel construction with the back of a book-shaped box or receptacle, in such a way that letters, invoices, and other similar papers, may be placed on a pair of needles fixed to the said back and retained by a spring. The latter is slotted, and so placed as to be capable of following the papers down on the needles.

IMPROVED UMBRELLA SUPPORTER.

August H. Adams, Piqua, Ohio.—This consists of an attachment for vehicles, having a socket for the umbrella handle at one end and double sockets at a suitable angle at the opposite end, to be secured by clamp screws to a grooved supporting post attached to the wagon seat.

IMPROVED EAR RINGS.

Leon P. Jeanne, New York city.—This invention consists of a spring lever hook, attached to a knob of the ear ring or drop, and bent upward, so as to bear on the ear, and retain the button securely in position.

IMPROVED BILLIARD BALL.

Gustav Magnus, Berlin, Prussia.—These balls are made uniformly solid throughout, without any pores or cavities. They are perfectly elastic. They rebound to a hight of eighty feet if thrown on an iron plate. Their center of gravity is exactly in the center of the ball, so that they lie still in any position on a surface of quicksilver. They do not crack or peel off, and they do not lose their color. The ingredients are rubber, sulphur, a suitable coloring matter, and heavy spar, or sulphate of baryta, the latter in a quantity at least fifty per cent of the rubber. The mixing is done in the usual way. After having made a ball, as nearly true as possible, and about one half inch smaller than the finished ball, it is enveloped in a sheet of the same mixture, having the required color, of three eighths of an inch thickness, and put in a very strong metallic mold of adequate form. The whole is then submitted to the curing process during at least ten hours, commencing with a low temperature, and increasing it slowly but steadily. The mixture is exposed only for one hour or less to the highest degree of heat, which will vary according to the quality of the india rubber used. The cured balls are then turned and finished.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WATER FENDER FOR DOORS.

Elliot L. Valentine, Oakalla, Ill.—This consists of a water conduit, made from sheet metal, to be attached to doors, windows, and other similar places, to catch the water that drifts against them, and conduct it outside the sill.

IMPROVED WASH BENCH.

Peter E. Rudel, Grand Rapids, Mich.—This is a folding wash bench, hinged to a vertical standard carrying wringer rolls. The bench is formed of two sections, which consist each of a platform supported upon a hinged frame or leg, and adapted to fold and lie close against the upper portion of the standard.

IMPROVED INVALID BEDSTEAD.

Franklin E. Sawyer, Hyde Park, Vt.—This bedstead may be easily and conveniently adjusted by the occupant or attendant to any position, to be used as a common bed, or as a sofa or settee, or at any inclination. It is also easily movable from one room to the other, and has accommodations for the storing away of soiled clothes.

IMPROVED BOTTLE WASHER.

William Scherenberg, New York city.—In using the machine, the bottles are placed in a frame and secured. A trough is then lowered, bringing funnels into the mouths of the bottles, into which water and shot, tacks, or other suitable substance, are poured. A wheel is then turned which shakes the frame and bottles, washing the said bottles clean in a short time. When the bottles are sufficiently washed the frame is turned through a half revolution, which allows the water and shot or tacks to flow from the bottles into a basin.

IMPROVED WASHING MACHINE.

Allen D. Ferris and Albert N. Ferris, Blakeley, Minn.—The suds box is made in the form of a half cylinder, and to it is attached a series of parallel cross bars, which form the rubbing board, and at the same time strengthen the zinc bottom. The top opening is surrounded with a curve which prevents any water that may be spilled from running off upon the floor, and serves as a rest for the attachment of a wringer. Devices are provided to hold the suds box stationary while the wringer is being used.

IMPROVED SPRING PILLOW.

Jacob Beamer, Manor Station, Pa.—The object of this invention is to furnish, in place of the feather pillow, an improved wire spring pillow, that is conducive to sound and healthy sleep by keeping the head cool, and admitting pure air to the back of the same. Wire cloth is stretched on curved band springs, which are attached to the lower ends to a suitable supporting frame, and at the upper ends, by a cross strip, to upright rack bars. The supporting springs are laterally braced by a curved stiffening rod.

IMPROVED EVAPORATOR FOR REGISTERS.

W. R. Fowle, Baltimore, Md.—The invention consists in moistening hot air as it passes into an apartment from a furnace or stove, by causing it to pass through strips of absorbent material, more or less saturated with water. The absorbents are endless pieces of fabric held by opposite rolls, and dipping into the water, being spaced by ring grooves in the top roll. The invention is equally adapted to any form or location of register by means of an attachment open at the bottom so as to enclose with a lid the ordinary floor register, and provided with a rear opening to correspond with that of the evaporator.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FARM GATE.

Dennis C. Bacon, Litchfield, Ill.—This consists in hitching the rear post of the frame to the main gate post, on which it turns by eyes and long staples.

IMPROVED CHURN.

David J. Rogers, Bardstown, Ky.—This invention relates to certain improvements in churns, designed to simplify and extend the use of the same, and expedite the operation of churning. It consists principally in the combination with a tube or case, provided with slits and perforations, of a projecting handle for holding the tube stationary against the bottom of the outer case while the dasher is being worked up and down in the said tube, by means of which arrangement any vessel without a special cover may be employed for the outer containing case, and the churning devices adapted for use in the one as well as in the other.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON SPRING ATTACHMENT.

Reuben Doty and Joseph Doty, Wellsville, N. Y.—This is a device for attaching springs to a wagon body, composed of a top plate, a cross bar, encircling clip or band, and downward extending lugs, to form shackles for springs, the whole made in one piece.

IMPROVED ROCKER AND TRACK FOR CRADLES AND CHAIRS.

Daniel Rupp, Four Corners, Iowa.—This device is so constructed that the rocker shall always have a smooth surface to rock upon, however rough the floor may be, or however soft the carpet. The invention consists of a track having a right-angled bracket with a V-shaped slot, in combination with a cradle rocker, having a pin which enters the slot in the bracket.

IMPROVED PORTABLE HOUSE.

Francis M. West, Des Moines, and Addison R. Smalley, Snyder, Iowa.—This is a portable house that may be readily shipped and set up, and taken to pieces in case of fire, or for moving, the construction being strong and durable, while at the same time neat in appearance. The walls are made of grooved and tongue-locked logs, with detachable door and window casings applied in similar manner. The floor is connected to the joints by pins and recessed locking strips, while the roof sections are supported on dovetailed rafters by lateral bearing strips and top battens, the parts being interlocked rigidly.

NEW TEXTILE MACHINERY.

APPARATUS FOR BOILING AND DYEING SILKS, ETC.

Lewis Leigh, Pittsfield, Mass.—This consists in the combination of the series of fingers, their connecting rods, and an operating mechanism, with the two vats for moving the rods that support the material being boiled or dyed, and in the combination, with the end of the outer vat, of a box, connected with the space between the two vats by an opening. The box receives the wash from the ebullition of the liquid in the first vat, and, being higher than the said vat, allows the liquid to flow back into the same, thus avoiding any risk from boiling a liquid in an airtight space.

IMPROVED SPINNING AND DOUBLING MACHINERY.

John L. Taylor and Robert Ramsden, Bolton, England.—This invention relates to the machines known as throstle spinning and double frames, and consists in imparting a positive motion to the bobbin on which the yarn or thread is wound, and a variable motion to the inverted flier, which is fixed to a bush, bearing upon a flannel or other washer placed on the lifting rail. The advantages claimed for the improvements are: First, no oil is required for the spindle to lubricate the bobbin after doffing, as heretofore; secondly, no snarling of the yarn on the top of the spindle can take place; thirdly, no friction of thread against the flier leg; fourthly, no removal of fliers when doffing; fifthly, a great saving of waste is effected, and of time in doffing, and the bobbins can be doffed while the frame is going; and, lastly, as the bobbins bear upon metal plates, they are not liable to be saturated with oil, and consequently no oil can penetrate to the yarn on the bobbin, as heretofore.

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Business and Personal,

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Agricultural Implements and Industrial Machinery for Export and Domestic Use. R.H. Allen & Co., N.Y.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Wanted—Parties to manufacture, on a royalty, an instrument to prove Steam Gauges. Address E. F. Osborne, St. Paul, Minn.

"Eureka"—Best Weather Strip out. Patent for Sale, cheap. Make an offer. I mean business. Illustrated in Sci. American, Oct. 9, '75. Frank Fleury, Springfield, Ill.

India Rubber—Capitalists are invited to Examine a new process of manufacturing India Rubber, by which one half the labor and machinery are saved. Address India Rubber, 52 Park Place, New York City.

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A good Machinist is wanted, who can invest $2,000 in a good paying business, which will be permanent. Address N. Upham, Agent, Athol, Mass.

A Scraper Patent for Sale. Address R. Verea, 88 Wall St., New York.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 189.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

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Jethro Wood.—If any of our readers can send or refer us to any publication containing a portrait of Jethro Wood, the plow inventor, we should be obliged. Munn & Co.

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See Boult's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

John McDonald (formerly of Kingston, Jamaica) will please address Geo. B. Lundy, Balmoral, Ontario, Ca.

Hydrant Hose, Pipes, and Couplings. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

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Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Enquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to enclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to enclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

T. B. G. can remove tattoo marks from the hands by the process described on p. 331, vol. 30.—G. B. should read our remarks on p. 202, vol. 34, on dissolving shellac.—B. can ebonize white wood by the process described on p. 50, vol. 33.—I. F. D. H. will find directions for making printing ink on p. 107, vol. 35.—Mrs. R. can chemically preserve natural flowers by dipping them in hot melted paraffin.—G. S. can best clarify varnish by filtration.—B. C. is informed that a recipe for erasive soap was published on p. 181, vol. 31.—B. L. F. will find directions for cutting glass with hydrofluoric acid on p. 379, vol. 33.—F. S. can polish white metallic alloys by the process described on p. 57, vol. 34.—R. W., T. D., W. S. H., W. B., W. A. R., A. A. C., G. M., J. B., J. M. P., J. E. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) M. M. C. asks: Does a point on a connecting rod between the centers of the crank pin and crosshead journal describe a perfect ellipse, or is the figure which it describes slightly larger at one end than at the other? A. Slightly larger at one end.

(2) A. W. H. asks: I have a side stroke slide valve portable engine. Cylinder is 7½ inches in diameter, with 14 inches stroke. It is rated at 12 horse power. I run a gin stand with it at speed of 250 to 300 revolutions per minute. I think it ought to run at 125 or 130 revolutions of the driving wheel per minute when the gin saws are at their maximum, 300 revolutions per minute. A friend contends that the engine would do the work more easily running at 75 revolutions per minute. Which is right? A. You are.

(3) J. P. says: Of what benefit is lagging between the jacket and the boiler of a locomotive? A. It prevents the heat passing off, by conduction, to the air.

(4) A. B. says: We have two engines, each 7x12 inches, attached to one shaft; they are reversible by link motions, and are provided with ordinary slide valves. One of the engines has too much opening on either center. How can we shorten the stroke so there will not be more than $\frac{1}{64}$ inch opening on either center? A. Place the eccentric more nearly at a right angle to the crank.

(5) G. M. F. asks: Will plaster of Paris, made in the form of a cup, answer for the porous cup in the Bunsen battery? A. No, for the reason that it is not porous.

(6) C. W. M. asks: 1. What should be the inside and outside diameter of a helix, whose length is 3 inches? A. Inside 1 inch, outside 2 inches. 2. Of what size should the wire be, to give the greatest lifting force? A. Use No. 14 copper wire. 3. Would any kind of wood do for a spool for winding it on? A. No spool is necessary. Wind the wire on the iron core.

(7) W. B. asks: If two magnets be placed parallel, with their opposite poles together, the poles will attract each other. If the magnets be placed end to end, with the positive pole of one to the negative pole of the other, they will repel, according to Ampere's theory, whereas in practice they attract. How is this explained? A. According to Ampere, they should attract under the conditions mentioned.

(8) A. S. says: I am making an electro-magnet, which I wish to insulate by winding on silk, and then dipping in paraffin. The only paraffin I can get here is made up into candles, which I fear may be adulterated with something that would spoil my wire after I have taken the pains to wind it. Would you advise me to use it? A. The silk is sufficient. The dipping in paraffin will do harm.

(9) M. A. G. asks: 1. Is a hollow lightning rod as good a conductor of electricity as a solid one of the same diameter and same metal? A. No. 2. Is the conductive property of a rod in proportion to its surface, or to its solid contents? A. To its solid contents.

(10) C. M. says: 1. I have an electrical conductor on my dwelling house, composed of three twisted iron wires and a small copper wire between each of the three strands, about ⅛ an inch diameter altogether. Is such a rod a suitable protector against electric shocks? A. Yes, if properly connected with the earth. 2. Would a galvanized iron rope of ¾ inch diameter be as good as a conductor? The rope would be probably twice the weight per foot of the lightning rod. A. Yes, better than the other.

(11) W. N. G. asks: What is the average distance which a printer's hand travels for each type set? A. About 30 inches.

(12) L. C. K. says: I wish to bring water into my house from a spring 30 rods from the house and 100 feet higher. I wish to use ½ inch iron pipe. I am told that it will fill in a short time with rust so as to stop the flow of water entirely. Would it be advisable for me to lay iron or lead pipe? A. A tin-lined iron pipe is now being introduced into the market, which we think will best answer your purpose, and probably not cost more than a lead pipe of sufficient thickness to bear the pressure.

(13) T. E, K. asks: Is there a preparation for rusting steam joints together? A. Use a mixture of cast iron borings 100 lbs. and sal ammoniac 8 ozs., well wetted with water.

(14) G. D. M. asks: Can you tell me what substance plasterers mix with their white glue in making molds for ornamental plaster work, to give a gray color and make it tough like rubber? A. No; glycerin is said to be a good coating for the interior, but lard and oil is most commonly used. Plaster casts, immersed in a hot solution of glue long enough to be well saturated, will bear a nail driven in without cracking.

(15) F. R. asks: Is solder as good after it has been in use on iron and brass as when new? A. No.

(16) L. S. C. asks: 1. What good material or paint can you recommend to cover a shingle roof, to make it approximately fireproof against sparks and heat in case of the burning of an adjoining building? A. Quicklime boiled in linseed oil and applied hot is said to be fireproof. 2. Can a durable wall 9 inches thick be made of sun-dried unburnt brick for a building one story high, the foundation being of burnt brick? A. We should consider the wall too thin: it is not likely to sustain the roof; 16 inches thick would do better. It could be laid up in clay. 3. Would hydraulic cement adhere to such a wall, if plastered on the outside? A. No; it would be better to fur off the inside, and lath and plaster it in the usual way.

(17) J. R. K. asks: Has the temperature any effect on a steel spring blade? A. The effect will not be noticeable by ordinary measurements.

(18) T. M M. asks: Is there not such a thing as getting lumber too dry? We kiln our lumber in a very hot dry house. Sometimes we leave it in a week longer than we should if we were in a great hurry for it. Our foreman claims that there is no such a thing as getting lumber too dry; but we find sometimes, after we have used lumber that has been in the kiln so long, that the end wood swells. A. We think your foreman is right; but kiln-dried lumber is no doubt more subject to swell by the absorption of moisture than that which is seasoned by long exposure to the action of the weather. If you stack your lumber two or three years before using it, you will no doubt have the best seasoned stuff.

(19) J. S. asks: How much powder will a small mortar, with a bore of 4 inches diameter and length 4½ inches, take to throw a shell ¼ of a mile? A. From ½ to ¾ lb.

(20) B. F. M. says: I have canned some blackberries and raspberries, but I have lost about 25 cans by the cans pulling in two; sometimes they will burst all to pieces. Can you give us some reason for it? A. In canning fruit it is necessary, in order to expel as much of the air as possible, as well as to destroy any incipient germs of fermentation, (1) that the vessels should be as full as possible and (2) that before being sealed they should be placed for a short time in boiling water until their contents become of the same temperature as the surrounding water, in which condition they should be sealed, and immediately thereafter removed and allowed to cool.

(21) L. A. asks: Is there anything except muriatic acid that I can use for soldering copper or tin to galvanized iron, or for soldering the iron itself, and make a smooth job? A. Use borax, acid chloride of zinc, or sal ammoniac.

(22) B. W. says: We have some steelyards that have no poise. Can you tell me how to make or adjust one? A. The principle on which the steelyard acts is that of the simple lever. If you can get two or three correct weights, you can make a poise by experiment. To calculate the proper weight of the poise, measure the lever arm of the weight, and that of the poise to one or more of the notches, and use the proportion that any given weight is to the required poise as the distance from the fulcrum to the poise is to the distance from the fulcrum to the weight.

(23) C. E. C. asks: How can I best succeed in getting a journal to make itself a seat in a bearing that is slightly too narrow for it? A. File out the sides of the bearing.

Is it likely that any other substance than oil or mud is the cause of the water foaming or surging in the upright tubular boiler? A. There are other causes, such as want of sufficient steam power.

(24) F. H. S. says: My friend claims that in a chronometer watch the escapement will commence to move at the same moment that the detent liberates the said escape wheel. I claim that the inertia of the train of wheels is sufficient to retard the time for commencement of motion of the escape wheel sufficiently to allow the balance to move through a space of at least three degrees from the time the detent has just liberated the escape wheel to the time that said escape wheel commences its movement with every beat of the balance, pendulum, or whatever it may be. Who is correct? A. Your view of the matter is the more correct of the two, though the amount of motion of the balance wheel before the other commences to move could only be settled by experiment. It should be noted, also, that the teeth of the escape wheel could have such a shape that it would be in motion while disengaging from the escapement. Possibly this is the case in some watches.

(25) J. E. W. says: I am running my engine at the rate of 175 revolutions per minute. What would be the difference in the amount of steam that I should use if I ran it at 200 revolutions per minute, provided that I increase the size of pulley on machinery so that the engine will be doing the same amount of work? A. There will be no great difference, but there will probably be a little gain by using the increased speed.

(26) A. L. asks: What would be the safe pressure for ½ inch external diameter steel pipe 0·3 inch in thickness, and also of 1 inch external diameter steel pipe, ¼ inch thick? A. About 5,000 and 2,000 lbs. per square inch respectively.

(27) W. R. H. says: In a recent issue you describe a new electric battery. I have had this battery in use since January last. The jar is a common glass tumbler. The zinc cylinder is sheet zinc, twice the hight of the tumbler. The porous cup is made of blotting paper around the zinc turned in at the bottom. The copper wire is coiled over the paper, which keeps the zinc and paper in place. Sulphate of copper solution is used as in a Daniell battery. This battery can be constructed for twenty cents, and will work from 5 to 8 weeks, producing a current suitable for experimental purposes. By making the zinc cylinder twice the hight of the tumbler, the battery remains in working order longer. The zinc, being very thin, is soon destroyed on the lower edge; but by pushing the cylinder down, the same amount of surface is exposed to the action of the acid. A. The Daniell battery is capable of many modifications, and this is as good as many others which have been used.

(28) E. S. asks: What will remove a linseed oil stain from common white cloth? A. Try benzine or naphtha, and press with a little warm pipe clay.

(29) R. T. S. asks: How can I dye white kid slippers black? A. First steep the material in a strong, hot solution of logwood, and then in one of sulphate of iron (copperas). Repeat if necessary.

(30) W. B. asks: How can I pulverize mica? A. Heat it as hot as possible, and while in this condition plunge it suddenly into cold water. It thus becomes very brittle and may be reduced without difficulty.

(31) W. G. S. asks: What is the hydraulic pressure of a column of water 30 feet high? A. About 12½ lbs. on the square inch.

Can I get a full large blaze from glycerin by putting the fluid above the light? I can get it to burn, but it gives a small blaze which, it seems, will not get any larger. A. A higher temperature in contact with the air will produce a rapid decomposition of the glycerin, giving a much stronger flame, but at the same time liberating irritating and offensive fumes of acrolene. 2. What is the cost of it compared with alcohol? A. Glycerin, in comparison with alcohol, is very cheap.

(32) D. F. E. asks: How much sand and lime does it take to mix one bushel of Rosendale cement in mortar for laying brick? A. One of cement, one of lime, and six of sand will make a good mortar for brickwork.

(33) W. G. W. says: I am bringing water 250 feet from a well through a 1¼ inches plain wrought iron pipe. The water is clear and good, to all appearance; but when it has stood in a pail or vessel of any kind an hour or more, a greasy reddish scum arises to the surface in sufficient quantity to color the inside, so that it requires considerable scrubbing to clean it off. Is there any chemical property in the water that causes the difficulty? A. The sediment you mention is very probably due to some corrosive action of the water on the iron conduits. This may be due in part to the presence of free carbonic acid. Draw a quantity of the water, add to it a small quantity of lime water, and allow to stand overnight; then draw off the clear water. The addition of the lime water will neutralize the free acid, with which it forms an insoluble salt, and at the same time precipitate any iron that may be in solution. Experience will soon teach you the proper quantity of lime water necessary.

(34) J. A. V. asks: What is the most efficient means of stopping and preventing leaks in gutters? I have one of copper that leaks terribly, thereby ruining the cornice of wood beneath. A. If your roof is a steep-pitched one, the copper lining of the gutter may not extend up far enough under the covering to prevent the water from flowing over the back edge of it, into the

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woodwork of the cornice; or the contraction and expansion may have worked the joints loose. The latter should be closely examined, and, if loose, repaired before painting. We find no difficulty here in keeping gutters, that are simply lined with tin, tight.

(35) C. F. S. asks: 1. Is the radiation of the method of heating private dwellings with furnace in basement and tin pipe leading to different rooms at the floor called direct or indirect? A. Indirect. 2. When this method is used, where should fresh air be admitted to the room thus heated, at the floor or near ceiling? A. Fresh air should be taken from the exterior of the house at the basement, and supplied to the air chamber of the furnace by a special pipe or shaft, which may be of wood; it is this air, when warmed, that becomes the fresh air of the rooms. The fireplace flue will carry off the vitiated air, having its opening near the floor.

Can cast iron be casehardened with prussiate of potassa? A. Yes.

(36) L. W. asks: Will any injurious effects arise from working over and inhaling the vapor or steam arising from boiling or hot aniline dye? A, Yes, it is extremely unhealthy, if from no other cause than induced predisposition of the system to take cold and contract pulmonary complications.

(37) A. H. S. asks: Is it injurious to a person's health to sleep in a printing office after working in it all day? It is said that the antimony in type metal is poisonous. A. If the office is well ventilated, and free from the odor of benzine and other exhalations, it will not be unhealthy. The antimony does not evaporate.

(38) G. G. says: I need a flexible tube to use in kerosene oil. What is the best material to make it of? A. Try one of leather. Rubber will not answer. 2. In a lamp burning kerosene oil, what is the best distance to have base of flame from surface of oil? A. About 2½ inches.

(39) E.T. M. says: I am about to construct a flume for carrying off the smoke from a quicksilver furnace, the smoke being strongly impregnated with sulphurous acid. What effect will it have on a four feet flue constructed of Portland cement, gravel, and sand? A. The effect will be to speedily convert the exposed surfaces of the lime into an oxysulphide, and finally into sulphate of lime, which will resist any further change.

(40) J. W. says: My cellar is always wet. If I dig a drain or two in it, and dig a well down to the gravel, the drains going into it, will the water soak in the gravel? A. It depends upon the nature of the several strata over which your house stands. Better consult some of the older residents of your neighborhood. See query 20, p. 107, vol. 35.

(41) M. E. A. asks: 1. I wish to build an icehouse on my farm, to hold about 8 tuns of ice, in which to keep meat, etc. A. You will find a description of one of this size on p. 251, vol. 31 (in which read "7 feet square" for interior chamber instead of 6.) 2. Is it best to build it into a bank and cover the top with earth, or build it all above ground? If the former, how shall I construct it? A. It is not necessary to build it in a bank; let the building be isolated, but the floor about 2½ feet below ground. 3. How should the door be made? A. Provide a canvas on the inside that will allow it to be packed with about 6 inches thick of sawdust. 4. Should the provisions be kept in the same room with the ice? A. No; but in the surrounding passage, as in the description above referred to.

(42) W. D. asks: Can vinegar be made directly from corn or corn meal without first converting the corn into starch, then to dextrin, and then to grape sugar, and then to vinegar? A. No.

(43) J. H. P. says, in reply to B. D., who says: "I have a piece of gold which has been polished with mercury. What will remove the mercury?" A. Cover the gold in a glass vessel with nitric acid. The acid will eat the mercury all off, and will leave the gold less brittle than if heat had been applied to it.

(44) E. P. says, in answer to C. B., who asks how to plow with three horses abreast, and regulate the running of the plow: We often do this by shifting the outer end of the clevis off the beam towards the land, and fastening it at the right distance with a guide pin.

(45) J. M. L. says, in reply to H. P. B., who asks if eggshells can be utilized: Eggshells form one of the best clarifiers for cider and wine. One pint of pulverized eggshells will clarify one barrel of cider or wine in from 24 to 48 hours, according to the clearness of the weather. As eggshells cannot always be had in sufficient quantities, can you tell me of a substitute for eggshells? What is the lime composition of the same? A. It is the small quantity of residual adhering albumen, and not the lime salts composing the shell, that exerts the clarifying action upon the the liquor. A good substitute for the expensive egg albumen may be obtained from water that has been used to wash the starch from wheat flour or scraped potatoes, by allowing it to stand until it becomes clear, and then boiling it. By this means it is rendered turbid, and, after a short time, a flaky white substance deposits, which has the same properties as white of egg, and is known as vegetable albumen. The shells are chiefly composed of the carbonate and phosphate of lime, together with a little organic matter. In some parts of Europe and elsewhere, it is common to clarify wines, etc., by heating for a short time with ordinary clean *papier maché*, and then filtering through bags of fine linen.

(46) N. A. B. asks: 1. Can I arrange the motive power of an electric clock so that a regulator will not be necessary, and so that slight variations in the force of the current will make no difference in the time kept? A. No. 2. I have an instrument for producing shocks by the extra current; it has no secondary coil. If I should attach a condenser to it, could I obtain any of the effects of frictional electricity, or is the secondary coil necessary? A. A secondary coil is necessary to obtain static effects of any considerable tension.

(47) J. V. A. says: Is there any metal or other substance that is perfectly or almost perfectly impenetrable to magnetism? If I take a magnet and place a plate of some substance above it, could the magnetism be prevented from going through it, so that it would have no influence on a piece of iron placed above it? A. No. There is nothing which will cut off magnetism except iron, which does so by itself absorbing the magnetism produced.

(48) W. H. asks: 1. How can hard cistern water be made soft and good for table use? The hardness arises from the cistern being built of cement. A. Boiling the water usually causes precipitation of some of the foreign matter. 2. Is a partition of common brick laid in cement, dividing the receiving conductor from discharge pump pipe, a good filter for a cistern? A. We think not.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Water Supply for Seaboard Towns. By H. B. M.
On Shrunk-On Parts of Machinery. By T. I. B.
On the Radiometer and its Uses. By S. H. T.
On the Pyramid and the Sphynx. By C. R.
On the Sinking of a Large Pond. By J. N.
On Working Men's Demonstrations. By J.E.E.
On a Submarine Railway. By P. S.
On Building Prisons. By H. G. K.
On the Hidden Key. By J. E. W.
On Preparing Ornamental Leaves. By M.A. K.

Also inquiries and answers from the following:

T. P. P.—J. B. H.—W. G. W.—W. W. K.—M. W. W

M. G. P. asks: Are not meerschaum pipes sometimes boiled in wax etc., to bring out the color? If so, what is the process?—F. S. K. asks: Please give me a recipe for keeping the weavil from corn after it is cribbed in the shuck.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are fent: "Who sells bicycles? Who bores for water by driving well tubes, and what is the cost of the operation? Who sells wooden clocks? Who makes envelope machinery? Who makes machinery for preparing moss for upholsterers' use?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 15, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Alarm, electric burglar, J. N. Larned 181,078
Animal tether, P. Francis 181,163
Ax, J. W. Warner 181,227
Baking and broiling, J. H. Bruce 181,139
Bale band tightener, C. H. Chase (r) 7,260
Bale tie tightener, J. Thayer 181,020
Bale tie, wire cotton, P. F. King 181,183
Ball thrower, mechanical, C. H. Bagley 181,128
Bark, rossing and grinding, S. R. Thompson (r) .. 7,264
Bellows, valve for, A. Smith 181,111
Belt, chain, J. Behel 181,028
Belt fastener, J. P. Burnham 181,035
Belt shifter, A. Crosby 181,049
Bill holder, revolving, S. W. Maynard 181,089
Bin, meal, D. C. Clous 181,141
Bits, etc., holding, W. H. Barber (r) 7,263
Boiler and setting, steam, T. R. Butman 181,237
Boiler furnace, steam, W. Swindell 181,222
Boiler furnace, steam, J. E. Wootten (r) 7,267
Bolts, etc., rolling screw threads on, T. T. Prosser 181,010
Bone black, drying, P. Farley (r) 7,266
Boot heel, C. Schwerdtfeger 181,109
Boots, etc., screw for, A. Angst 181,126
Bosom form, A. W. Thomas 181,019
Bottles, cork fastener for, W. D. Balcom 181,026
Bracket, Jenks & Hyatt 181,178
Brick machine, R. A. Drawdy 181,058
Broom, S. Hobbs 181,170
Brush, R. Rosenthal 181,209
Brush and sprinkler, G. Birtwistle 180,985
Buckle, Clinton & Bassett 180,992
Buckle, A. B. Woodard 181,023
Buckle and snap, R. S. B. Chinnery 181,048
Buckle and snap hook, F. J. Deisz 181,052
Buckle, harness, W. F. Whitney 181,229
Building block, cellular wall, N. J. Clayton 181,043
Bustle, E. J. Ham 181,068
Butter package, B. Beiler 181,130
Button pliers, C. M. Platt 181,204
Can, square, J. H. Scott 181,011
Cannon, R. B. H. Leighton 181,081
Car coupling, E. Zorger 181,023
Car draft bar, railway, W. R. Cross 181,048
Car, sleeping, W. H. Paige 181,005
Car truck, J. Ireland 181,177
Cars, dust guard for, W. Carr 181,038
Carpet fastener, U. S. Dieffenbacher 181,149
Casting, collapsing core for, J. K. Dimmick 181,151
Casting die plates, J. B. McCune 181,194
Chain, C. W. Levalley 181,082
Chair, folding, W. B. Cogger 181,143
Chair, folding, A. Matthiessen 181,088
Chair, folding, F. F. Parker 181,100
Chair, folding, J. H. Travis 181,225
Chair, perambulating, T. Divine 181,056
Chair, reclining, T. M. Brintnall 181,137
Chair rocker, P. C. Ingersoll 181,176
Chair, tilting, H. Parry 181,207
Chamber and urinal, P. F. Campbell 181,037
Chimney cowl, J. M. Davies 181,050
Churn, P. K. Parkhurst 181,006
Cigar box, T. A. Dodd 181,057
Cigarette papers, case for, Beebe *et al.* 180,984
Clock dial, H. F. Henderson 181,001
Cloth-cutting machine, R. B. Sanson 181,107
Clothes dryer, E. B. Gildersleeve 181,164
Coal hods, bottom for, G. F. Sawyer 181,013
Commode, S. E. Smith 181,216
Cooler, beer, W. Lawrence 181,079
Cooler, milk, T. Sexsmith 181,110
Corkscrew, R. Decker 181,147
Cotton, baling, R. De Gray 181,052
Cotton chopper and scraper, W. M. Sanders 181,211
Cotton, borated, C. G. Am Ende 181,024
Cotton gin, H. A. Stearns 181,017
Cotton gin feeder, F. W. Flynn (r) 7,261
Cradle for children, Frawley & Eviston 181,162
Cultivator, J. W. Chase 181,041
Cultivator, H. D. Green 180,999
Cultivator, corn, G. Bradley 180,987
Cultivator, prairie sod, W. J. Robertson 181,106
Curtain tassel clasp, J. M. Homiston 181,171
Cutter head, J. H. Whitaker 181,230
Desk, C. A. Atkinson 181,025
Digger, potato, E. Bartlett 181,027
Digger, potato, A. L. Libbey 181,191
Digger, potato, S. Martin 181,193
Dish and clothes washer, A. C. Jackson 181,075
Disks of metal, etc., cutting, D. Brix 181,138
Distilleries, mashing, etc., for, G. Ellenberger. 181,060
Dock, floating, T. J. Wneeden 181,021
Drag teeth clasp, J. Gmeiner 180,997
Drawing frame stop, I. N. Edgerly 181,059
Dryer, Adams & Blondin 181,122
Elevating and carrying, B. T. Snyder 181,219
Elevator, J. G. Kurtz 181,077
Elevator and purifier, water, T. T. Bishop 181,134
Elevator, brick and mortar, T. Mann 181,085
Elevator, hydraulic, T. Stebins 181,113
Engine, compound, E. F. Althans 181,124
Engine cut-off, steam, J. C. Debes 181,051
Engine, rotary, A. C. Speer 181,112
Engine valve, pumping, Cope *et al.* 181,045
Engines, valve for steam, T. & A. Shary 181,212
Eyeglass, J. S. Spencer 181,016
Faucet-locking device, L. Bieler 181,031
Feather renovator, W. M. Shelton 181,213
Fire kindler, S. S. Brown 181,033
Flour bolt, W. D. Murray 181,095
Flying machine, F. X. Lamboley 181,186
Fountain for mineral waters, etc., A. D. Puffer. 181,103
Frame for family records, L. Patterson 181,008
Fruit and jelly masher, etc., A. Conrady 181,044
Fruit dryer, A. M. Mortimer 181,094
Fruit jar, H. D. Hall 181,067
Furnace for roasting ores, H. G. Livermore 181,088
Furnace, heating, T. Angell 181,125
Gas machine, A. C. Rand 181,204
Gasaliers, tube retainer for, J. C. Cassidy 181,140
Gate, U. W. Hardy 181,071
Gearing, double, J. Smith 181,218
Generator water indicator, E. H. Ashcroft 181,127
Glove, J. L. E. Ranniger 181,011
Governor attachment, C. Neer 181,096
Grate, transverse rocking, H. Swindell 181,221
Grating, burglar-proof, C. P. Haughian 181,070
Gravestone, metallic, W. J. Dew 181,148
Grindstone hanging, C. Hefft 181,000
Gun barrels, turning, H. C. S. Dyer 181,154
Gun, battery, A. E. Miltimore 181,093
Hame, A. H. W. Michaelis 181,092
Harness pad, Ridgley *et al.* 181,207
Harrow, J. De Moss 181,054
Harrow tooth, D. W. Hughes 181,173
Harrow teeth blanks, making, G. Donaldson 181,152
Harvester, W. H. Pritz 181,203
Harvester spring lever, T. S. Brown 180,988
Hay and stock rack, J. F. Temple 181,116
Hay for fuel, twisting, J. S. Foster 131,160
Hinge, spring, I. Buckman 180,989
Hoof spreader, McIntosh *et al.* 181,091
Horse collar, C. J. Fox 181,161
Hydrant or water plug, E. R. Jones 181,076
Ice cream freezer, C. L. Dexter 181,055
Ironing board, M. A. Bryant 181,034
Knitted goods, finishing, J. L. Williams 181,232
Lamps, torch for lighting, F. Billingham 181,030
Lantern, T. B. Osborne 181,097
Lantern, signaling, H. H. Schulte 181,108
Latch and lock, W. H. Taylor 181,115
Lathe, gage, L. Hull (r) 7,262
Lathe shaping attachment, W. Brede 181,032
Limekiln door, W. Gwynn 181,238
Lubricating compound, Lyon *et al* 181,080
Match holder, W. Ferguson 180,995
Mattress, life-preserving, G. N. Torrence 181,118
Metals, refining, Corson *et al.* 18.,046
Microscope, J. Zentmayer 181,120
Millstone dress, J. K. Snavely 181,015
Mosquito bar, A. L. Edwards 181,157
Mowing machine coupling, D. Manning 181,192
Music leaf turner, O. W. Clark 180,991
Nut lock, Haldeman & Stewart 181,166
Ores, reducing, M. Laflin 181,003
Ornamenting surfaces, M. Dietrich 181,150
Overalls, G. R. Eager 181,155, 181,156
Overalls, S. Laskey 181,190
Painter's duster, etc., J. V. Richardson 181,206
Paper bag, J. S. Ostrander 181,198
Pen-handle attachment, W. H. Foye 181,062
Penholder, fountain, L. Berg 181,132
Pianoforte, bell, Hill & Wing 181,169
Pistols, extensible stock for, E. Wilson 181,238
Planter, corn, S. E. Owen 181,499
Pliers, W. P. Huntoon 181,175
Plow draft, A. B. King 181,180
Plow, stock, J. A. Price 181,102
Plow, sulky, A. Hamilton 181,069
Plow, sulky, J. M. Payne 181,200
Plows, weed turner for, W. Banworth 181,129
Post hole borer, Caler & Merrick 181.036
Press, cotton, W. Golding 180,998
Printing press, E. Hely 181,078
Privy seat, Howard & Allard 181,172
Pump, chain, J. S. Corbin 181,145
Pump, submerged, J. W. Collet 181,144
Pump valve, Hill & Rowland 181,168
Pump bucket, chain, Potter *et al.* 181,202
Railway gate, M. Fulcomer 181,163
Railway rail joint, J. De Pew 180,994
Railway signal, automatic, J. E. Ross 181,012
Railway time signal, J. C. Paige 181,098
Railway track, lifting, R. Aldred 181,123
Rake and tedder, hay, E. J. Knowlton 181,184
Rake, horse hay, A. W. Coates 181,142
Refrigerator, J. J. Ross 181,210
Rivets, etc., making, E. E. Pierce 181,101
Roofing, making composition, C. L. Fowler 180,996
Ruler and protractor, G. D. Wyckoff 181,236
Saw tooth, A. Boynton 180,986
Scales, automatic, C. A. Whedon 181,228
Scales, weighing, A. Pangburn 181.090
Seeds, coating, W. R. Brandriff 181,136
Separator, grain, T. C. & J. W. Jory 181,181
Separator, middlings, C. F. Keller 181,182
Sewers, expansible gate for, Brady & Manning 181,135
Sewing machine, shuttle carrier, A. W. Eldredge 181,158
Sheet metal box, O. M. Sloat 181,215
Shirt bosom, S. Laskey 181,189
Shoes, etc., fastening, G. W. Lascell 181,187, 181,188
Sign, revolving, J. O. Belknap 181,029
Skirt elevator, A. W. Thomas 181,018
Smoke, consuming, J. Todd 181,117
Soda fountain, G. F. Heinichen 181,167
Spinning flier, F. P. Holt 181,002
Stone channeling machine, N. J. Green 181,066
Stool, blacking, A. Waterman 181,119
Stove attachment, cooking, T. R. Timby 181,224
Stove, cooking, J. C. McClamroch 181,090
Stove leg or foot, self-locking, W. W. Tice 181,223
Stove, summer, C. H. Chase 181,040
Studs, etc., making, Potter & Buffington 181,009
Sugar machine, centrifugal, E. Rochow 181,208
Sugar, refining, J. Wilhelm 181,231
Swing, A. Sieaforth 181,214
Syringes, etc., piston for, R. Vander Emde 181,226
Tanning process and compound, W. Farris 181,061
Telegraph circuit, fire alarm, J. P. Barrett 180,983
Toilet cabinet, D. Daggett 180,993
Tool, combination, M. Reynolds 181,104
Toy blow horn, C. W. Fallows 184,1
Toy gun, C. W. Fries 181,0
Toy spring gun, S. G. Stryker 181,114
Transplanter, J. E. Goodwin 181,065
Trap, animal, J. Martin 181,086
Trap, animal, F. E. Rice 181,105
Trap, fly, C. Olson 181,197
Trap, roach, R. Hagen 181,165
Umbrella, G. Bockstaller (r) 7,265
Umbrella, Hayward & Hoyland 181,072
Umbrella supporter, A. H. Wright 181,235
Valve, cut-off, F. B. Rice 181,205
Valve gear for reversing, W. H. Downing 181,152
Valve, oscillating, W. Bellis 181,131
Wagon beds, attaching derricks to, G. H Smith .. 181,217
Wagon cover, C. Cremer 181,047
Wagon, steam, S. B. Stone 181,220
Washer, steam, C. C. Carter 181,039
Washing machine, J. J. Daly 181,146
Washing machine, G. W. Marlatt 181,087
Washing machine, G. L. Witsil 181,234
Washing machine, J. Zeller 181,121
Watch key, W. S. Hicks 181,074
Water conductor fastener, L. Berger 181,133
Water wheel, B. C. Lambeth 181,185
Water wheel, L. Long 181,084
Weather strip, J. H. McIntire 181,195
Windmill, M. T. & M. C. Chapman 180,990
Windmill, A. Humphrey 181,174
Windmill, W. W. Marsh 181,004
Windmill, D. Nysewander 181,196
Writing instrument, C. M. Johnson 181,179

DESIGNS PATENTED.

9,437.—UMBRELLA.—G. Bockstaller *et al.*, St. Louis, Mo.
9,438.—SKIRT BORDERS.—G. Bowman, New York city.
9,439.—EMBROIDERY.—E. Crisand, New Haven, Conn.
9,440 to 9,443.—CENTER PIECES.—S. Kellet, San Francisco Cal.
9,444.—FLOWER BOXES.—J. Rogers, New York city.
9,445.—STOVE.—E. Smith, Albany, N. Y.
9,446.—MIRROR FRAME.—R. W. Myers, New York city.
9,447.—FORK HANDLES, ETC.—C. Osborne, New York city.
9,448.—FAN.—J. T. Rowand, Jr., Camden, N. J.

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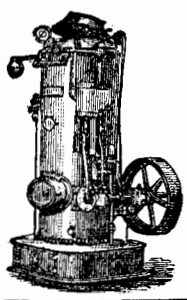

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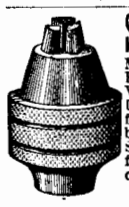

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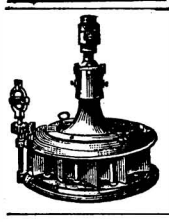

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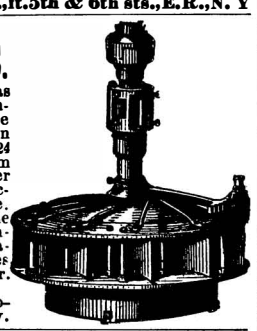

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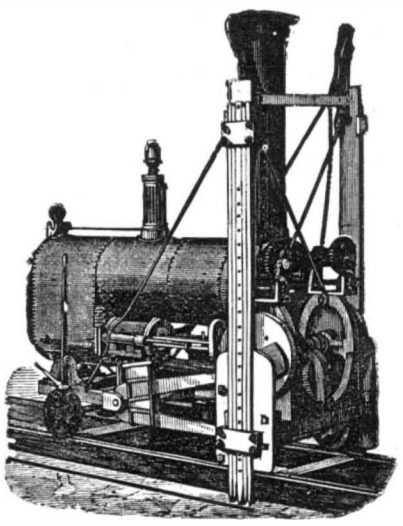

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